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FLORA OF
BRITISH INDIA

by

Sir Joseph D. Hook

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BY

SIR JOSEPH D. HOOKER, G.C.S.I.

(Under Revision.)

LONDON:
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Rec'd Apl. 1907

PREFATORY NOTE.

THE accompanying sketch of the Flora of British India has been written as a chapter in the Descriptive volume of "The Indian Empire," to be published with the forthcoming new edition of the Imperial Gazetteer of India.

It is now issued, in an advanced form (subject to revision), with the authority of the Secretary of State, and in response to representations from distinguished botanists in Europe and India, in order that, with as little delay as possible, it may be in the hands not only of Indian botanists and foresters, but of all who take an interest in the vegetable productions of our vast Imperial possessions in the East.

With the special object of encouraging investigation of the large areas indicated in the sketch as still botanically unknown, a certain number of copies have been sent for distribution to the editor of the *Records of the Botanical Survey of India.*

J. D. H.

13549. I. 2039. 600.—1/1904.

A SKETCH

OF THE

FLORA OF BRITISH INDIA,

BY SIR JOSEPH HOOKER.*

INTRODUCTION.

THE term British India as employed in this chapter embraces, over and above the vast territory controlled by the Government of India, some wholly independent countries, of which Nepāl, and the Himālaya east of Sikkim are the chief; together with Ceylon and the Malayan Peninsula, which are in great part under the Colonial Government.

The Geographical and Climatal features of India, upon which the distribution of its Flora so much depends, can be here introduced only incidentally. They will be found to be fully discussed in an earlier chapter of this volume of the Imperial Gazetteer.†

The term Flora applies in this sketch to native Flowering plants, Ferns, and their allies. Collected materials do not exist for discussing the distribution of Mosses, Hepaticae, Lichens and Fungi, which abound in most parts of India, or of the Algæ in its seas and fresh waters. On the other hand such extensive herbaria of the higher Orders of plants have, during the last century especially, been made over most parts of British India, that the study of their contents may be assumed to provide sufficient materials for a review of its Flora.

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* In compiling this sketch I have had the advantage of receiving valuable facts and suggestions from Sir G. King, K.C.I.E., F.R.S., late Director of the Royal Botanic Gardens, Calcutta, and J. S. Gamble, M.A., C.I.E., F.R.S., late of the Indian Forest Department.

† *See* also "Introductory Essay to the Flora Indica," by J. D. Hooker and Thomas Thomson, pp. 280, with 2 maps, London: Pamplin & Co., 1855.

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The Flora of British India is more varied than that of any other country of equal area in the Eastern hemisphere, if not in the globe. This is due to its geographical extension, embracing so many degrees of latitude, temperate and tropical; to its surface rising from the level of the sea to heights above the limits of vegetation; to its climates varying from torrid to arctic, and from almost absolute aridity to a maximum of humidity; and to the immigration of plants from widely different bordering countries, notably of Chinese and Malayan on the east and south, of Oriental,* European and African on the west, and of Tibetan and Siberian on the north. Whether India is richer in number of genera and species than any other area on the globe of equal dimensions is doubtful; it is certainly far poorer in endemic genera and species than many others, especially China, Australia, and South Africa.

Of the elements of the Indian Flora the Malayan is the dominant, but until the Floras of Sumatra, Tonkin and South China are better known, it is not possible to estimate its comparative strength. The Oriental and European elements can be approximately estimated. About 570 European genera and 760 species are indigenous in India, of which about 430 genera and over 400 species are British; and if the Oriental genera and species be added to the European, these figures would probably be doubled. The African element, which includes the Arabian, is third in amount, and it will no doubt be augmented as the Flora of Equatorial Africa becomes better known. The Tibetan and Siberian elements, which include an Arctic, are all but confined to the alpine regions of the Himālaya. Lastly, the Chinese and Japanese Floras are strongly represented throughout the temperate Himālaya and in Burma.

Of the Natural Orders of flowering plants, Ferns and their allies comprised in the Flora of British India, not one is peculiar to it; and if the genera common to it and to one or more of the adjacent countries be excluded, few endemic genera remain, and such of them as are endemic are local, and with few exceptions are restricted to one or few species.[*] It may hence be affirmed that in a large sense there is no Indian Flora proper.[†]

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* The term "Oriental" is unfortunately used in a very different sense by Botanists and Zoologists. In 1755 it was adopted by Gronovius as the title "Flora Orientalis" of his work on the plants of the Levant and Mesopotamia; and it is the title of Boissier's great Flora of the East from Greece to Afghanistan inclusive. This meaning has long been accepted by botanists. In zoological literature, "Oriental" is more synonymous with Eastern India.

The British Indian Flora, though so various as to its elements, presents few anomalies in a phytogeographic point of view. The most remarkable instances of such anomalies are the presence in it of one or a few species of what are very large and all but endemic genera in Australia, namely *Bæckia*, *Leptospermum*, *Melaleuca*, *Leucopogon*, *Stylidium*, *Helicia* and *Casuarina*. Others are *Oxybaphus himalaicus*, the solitary extra-American species of the genus; *Pyrularia edulis*, the only congeners of which are a Javan and a North American; and *Vogelia*, which is limited to three species, an Indian, South African and Socotran. Of absentee Natural Orders of the Old World, the most notable are *Myoporineæ*, which, though mainly Australian, has Chinese, Japanese, and Mascarene species; *Empetraceæ*, one species of which girdles the globe in the north temperate hemisphere and re-appears in Chili (the rarity of bog land in the Himālaya must be the cause of its absence); and *Cistineæ*, an Order containing upwards of 100 European and Oriental species, of which one only (a Persian) reaches independent Baluchistan. The absence of any indigenous Lime (*Tilia*) or Beech (*Fagus*) or Chestnut (*Castanea*) in the temperate Himālaya is remarkable, all three being European, Oriental, and Japanese genera. The Chestnut, which has been introduced into N.W. India from Europe, ripens its fruit there.

With the exception of the Rhododendron belt in the high Eastern Himālaya, there are in India few assemblages of species of peculiar or conspicuous plants giving a character to the landscape over wide areas, as do the Heaths in Britain, the Heaths and succulent plants in South Africa, the *Eucalypti*, *Epacrideæ* and *Proteaceæ* in Australia, the *Cacti* in America, or the great Aloes and Euphorbias in East Tropical and South Africa; nor are there representatives of the Pampas, Catingas, Savannas, or Prairie vegetation of America. The Coniferous forests of the Himālaya resemble those of other northern countries and the great Teak forests have no peculiar features.* The wood-oil trees (*Dipterocarpi*) in Burma form an exception, towering over the forests of Arakan and Tenasserim. Of gregarious trees, some of the most conspicuous are the Sal (*Shorea robusta*), Eng (*Dipterocarpus turbinatus*), Sissoo (*Dalbergia Sissoo*), Khair (*Acacia Catechu*) and Babul (*A. arabica*).

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[*] Of these exceptions perhaps the most notable one is that of two genera of *Dipterocarpeæ*, *Doona* with 11 species, and *Stemonoporus* with 15, which are both confined to Ceylon.

[†] Mr. C. B. Clarke, in a most instructive essay "On the Botanical Sub-areas of British India," has speculated on the successive periods at which the component elements of the Flora were introduced, and has arrived at the following division: (1) The Deccan or Indo-African, (2) the Malayan, (3) the Central Asian, (4) the European. Mr. Clarke's sub areas approximately correspond with the Provinces of this sketch. See *Journal of the Linnean Society*, Botany, vol. xxxiv. (1898), p. 142.

Indigenous Palms are few compared with many regions in tropical America, and are comparatively unobtrusive. The Talipot Palms (species of *Corypha*) are the most majestic Palms in India, in stature, foliage and inflorescence, but they are exceedingly rare and local. The Indian Date (*Phœnix sylvestris*), the Fan-Palm or Palmyra (*Borassus flabellifer*) and the Coco-nut near the sea, are the only palms that may be said to be conspicuous in the landscape of the plains of India. On the other hand, graceful, erect or climbing Palms with pinnate or fan-shaped leaves frequent the humid evergreen forests, where the rattans (*Calami*) ascend the trees by their hooked spines and expose their feathery crowns to the light. Bamboos, of which there are more than 120 kinds in India, are, as elsewhere in the tropics, important features, whether as clumps growing in the open, or forming in association all but impenetrable jungles; the taller kinds monopolise large areas in the hot lower regions, and the smaller clothe mountain slopes up to 10,000 feet in the Himālaya. Tree-ferns, of which there are about 20 (?) species, frequent the deepest forests of the Eastern Himālaya, Burma, Malabar, the Malay Peninsula and Ceylon.

Of shrubs that form a feature in the landscape from their gregarious habits, the most conspicuous examples are the Rhododendrons of the temperate regions of the Himālaya, and the genus *Strobilanthes* in the Western hills of the Peninsula; many species of the latter genus do not flower till they have arrived at a certain period of growth, and then, after simultaneously flowering, seed profusely and die. Some Bamboos, also gregarious, display the same habit, which they retain under cultivation in Europe. Three local, all but stemless Palms are eminently gregarious; *Phœnix farinifera* of the Coromandel coast, *Nannorhops Ritchieana* of extreme North-West India, and *Nipa fruticans* of the Sundarbans. Amongst the herbaceous plants the beautiful genus *Impatiens* takes the first place, from abounding in all humid districts except the Malay Peninsula, and from its numerous species being (with hardly an exception) endemic; added to which is the fact that, though profuse in individuals, the species are remarkably local, those of the Eastern Himālaya differing from those of the Western, these again from the Burmese, and all from those of the Western Peninsula and Ceylon; and most of these last from one another.

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* For an account of the Indian forests reference must be made to the chapter on Forestry in this Gazetteer, and for details to Gamble's *Manual of Indian Timbers* (London, 1902). In the latter invaluable work, 4,749 woody plants are recorded for British India (exclusive of those of the Malayan Peninsula), and of these 2,518 are trees, 1,429 shrubs, and 807 climbers.

Of fresh-water flowering plants, floating or wholly or partially submerged, there are many kinds in India. They include the beautiful white, red and blue *Nymphæas*, *Nelumbium speciosum*, and *Euryale ferox*, the latter a near ally of the *Victoria Regina* of South American waters; also many carnivorous Bladder-worts (*Utricularia*) and the curious *Aldrovandra* with leaves like those of the Venus Fly-trap, a South European plant, hitherto found nowhere in India except in some saline ponds near Calcutta. The most remarkable among the Indian fresh-water plants are the Podostemonads, which clothe rocks and stones in rapid streams with submerged spreading fronds, resembling green Lichens more than flowering plants. They are most common in Malabar and Ceylon, and are never found in rivers that have glacial sources. Marine flowering plants are few indeed, and are mostly of wide Oceanic distribution. Of peculiar littoral sand-hill plants there are few, the most notable being the above-mentioned *Phœnix farinifera*, *Ipomœa biloba*, and a curious grass, *Spinifex*, of Australian affinity. The estuarial plants will be enumerated when describing the tidal flora of the Sundarbans.

The number of recorded species of Flowering plants, in India, approaches 17,000,* under 176 Natural Orders;† and there are probably 600 species of Ferns and their allies.

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* In the *Flora of British India* (1872–1897) about 15,900 species of Flowering plants are described. But since the publication of the first volumes of that work the greater part of Burma has fallen under British rule, and large accessions have been made to the Indian Flora from that and other quarters, especially from the Malay Peninsula.

† In the *Genera Plantarum* (by G. Bentham and J. D. H., 1862–1883), 200 Natural Orders of Flowering plants are described. Some of these have been rightly subdivided by earlier or later authors.

The largest Order of Flowering plants in all India is *Orchideæ*, of which more than 1,600 species are recorded and additions are constantly being discovered. The greater number of these are tropical and epiphytic, and with comparatively few exceptions all are endemic. Ten are European and they are British.* It is only in the Eastern Himālaya, Burma and the Malay Peninsula that the Order predominates; in other parts of India *Leguminosæ*, *Gramineæ* and *Euphorbiaceæ* outnumber them.

The ten dominant Orders of Flowering plants in all British India are in numerical sequence:—

1. *Orchideæ*.
2. *Leguminosæ*.
3. *Gramineæ*.
4. *Rubiaceæ*.
5. *Euphorbiaceæ*.
6. *Acanthaceæ*.
7. *Compositæ*.
8. *Cyperaceæ*.
9. *Labiatæ*.
10. *Urticaceæ*.

Of these all but *Labiatæ* and *Compositæ* are more tropical than temperate. *Compositæ* take a very low place, and would, but for the temperate and alpine Himālayan species, take a very much lower. In this respect India shares, with the whole Malayan Archipelago, an exceptional poverty in what is not only the largest of all the Orders of Flowering plants in the world, but the one that heads the list in most other parts of the globe.

The following data,† deduced from the whole Indian Flora, are of use for comparison with those of its several botanical provinces. The proportion of Monocotyledons to Dicotyledons is approximately as 1 to 2·3; of genera to species as about 1 to 7. Of Palms there are more than 220 recorded species; of Bamboos, 120; of Conifers, only 22; of *Cycadeæ*, 5. Of genera with 100 or more species there are 10, of which 4 are Orchids, headed by 200 of *Dendrobium*; the others are *Impatiens*, *Eugenia*, *Pedicularis*, *Strobilanthes*, *Ficus*, *Bulbophyllum*, *Eria*, *Habenaria*, and *Carex*.

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* *Corallorhiza innata*, *Goodyera repens*, *Spiranthes autumnalis* *Listera ovata* and *cordata*, *Epipogum aphyllum*, *Cephalanthera ensifolia*, *Epipactis latifolia*, *Orchis latifolia*, *Habenaria viridis*, *Herminium Monorchis*. All these are temperate Western Himālayan; a few are also Eastern.

† It need hardly be pointed out that throughout this sketch numbers are approximate only, and are liable to revision.

BOTANICAL REGIONS AND PROVINCES OF BRITISH INDIA.

British India is primarily divisible into three Botanical areas or regions, a Himālayan, an Eastern and a Western. The two latter are roughly limited by a line drawn meridionally from the Himālaya to the Bay of Bengal. The prominent characters of the three are, that the Himālayan presents a rich tropical, temperate and alpine Flora, with forests of Conifers, many Oaks, and a profusion of Orchids; the Eastern has no alpine Flora, a very restricted temperate one, few Conifers, many Oaks and Palms, and a great preponderance of Orchids; the Western has only one (very local) Conifer, no Oaks, few Palms, and comparatively few Orchids. Further, the Himālayan Flora abounds in European genera; the Eastern in Chinese and Malayan; the Western in European, Oriental and African. These three Botanical regions or areas are divisible into nine Botanical Provinces, for the determination of which I have, after long deliberation, resorted to the number of species of the ten largest Natural Orders in each Province as the leading exponent of their botanical differences. The nine Provinces are:—

i. The Eastern Himālaya, extending from Sikkim to the Mishmi mountains in Upper Assam.

ii. The Western Himālaya,* extending from Kumaun to Chitrāl.

iii. The Indus Plain, including the Punjab, Sind, and Rājputāna west of the Aravalli range and Jumna river, Cutch and Gujarāt.

iv. The Gangetic Plain from the Aravalli hills and Jumna river to Bengal, the Sundarbans, the plain of Assam, and the low country of Orissa north of the Mahānadi river. This Province is divisible into three Sub-Provinces, an upper dry, lower humid, and the Sundarbans.

v. Malabar in a very extended sense—the humid belt of hilly or mountainous country extending along the western side of the Western Peninsula, from the mouth of the Tāpti river to Cape

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* The independent Kingdom of Nepāl, extending for 500 miles between the Eastern and Western Himālaya, is here left out of account, from ignorance of its flora. Except a very limited collection made in the valley of Khatmāndu by Wallich in 1821, the Flora of Nepāl is all but unknown. Great as are the differences between the Floras of Sikkim and Kumaun the two meet in Nepāl, as indicated by Wallich's collections, which further contain a considerable number of endemic species.

Comorin. It includes the Konkan, Kanara, Malabar proper, Cochin, Travancore, and the Laccadive Islands.

vi. The Deccan in a very broad sense, that is, the whole comparatively dry elevated table land of India east of Malabar and south of the Gangetic and Indus Plains, together with, as a Sub-province, the low-lying strip of coast land extending from Orissa to Tinnevelly, known as the Coromandel coast.

vii. Ceylon and the Maldive Islands.

viii. Burma, bounded on the N. and N.E. by the flanking mountains on the south of the Assam valley and China, on the east by China and Siam, on the west by Bengal and the Indian Ocean, and on the south by the State of Keda in the Malay Peninsula. The Andaman Islands, and possibly the Nicobar, belong to the Burmese Province.

ix. The Malay Peninsula, from Keda to Singapore, including the British protected States in this Peninsula. The British provinces proper are Wellesley, the Island of Penang, Malacca, and Singapore. The Nicobar Islands may belong to this Province.

A glance at the map of India shows that, in this attempt to delimit these Botanical Provinces geographically, large areas are in some cases difficult to apportion, as, for example, Gujarāt, of which the N.W. half is probably referable botanically to Sind, the S.E. to the Konkan. The eastern limit of the Malabar Province is undefinable, because of the number of spurs and valleys from its hills which project far into the Deccan Province, sometimes almost crossing it, carrying with them types of the Malabar Flora. The Flora of the trans-Indus mountains bounding the Indus Plain Province on the west, of which the eastern flanks are British Indian, is known botanically in one valley only, the Kuram. To have referred this either to the West Himālaya Province, or to Afghānistān, would have been premature. It is therefore treated of in an Appendix (A) to this sketch; as is also the Flora of British Baluchistān (Appendix B), which differs considerably from that of any other Botanical Province of India.

These Provinces coincide roughly with the areas of comparative humidity or dryness, indicated by Major Prain in his *Plants of Bengal* (introduction, p. 2) as follows:—

India Deserta; Sind, Rājputāna and the Punjab (the Indus Plain Province).

India Diluvia; with its chief development in the Gangetic plain, comprising much of the territory that constitutes politically the United Provinces and Bengal. (The Gangetic Plains Province.)

India Aquosa; the wet forest tracts along the Western Ghāts from Gujarāt to Travancore, which receives all the force of the S.W. Monsoon. (The Malabar Province.)

India Vera; the dry but not desert triangle between the Western and the Eastern Ghāts of the Western Peninsula, with its apex in Tinnevelly, and its base skirting the Gangetic plain. (The Deccan Province.)

India Subaquosa; the Eastern Ghāts and the strip between them and the sea. (The Coromandel Coast.)

India Littorea; most highly developed in the Gangetic delta. (The Sundarbans Sub-province.)

They also approximate to the botanical sub-areas of British India drawn up by Mr. C. B. Clarke in his instructive Essay in the *Journal of the Linnean Society* (vol. xxxiv. (1898) p. 142) with an excellent map. The principal differences between his Sub-areas and my Provinces lie in his inclusion of Central Nepāl in the Eastern Himālayan Province, and of the Afghān E. boundary mountains, all Baluchistān, S.E. Rājputāna and Central India in the Indus-plain Province; in his treatment of N. and N.E. Burma with the Assam Valley as a separate sub-area (Assam); of eastern and southern Burma as another (Pegu); and of his inclusion of all Ceylon in the Deccan Province.

The Flora of British India has been described at much greater length than in this sketch in the Introductory Essay to Dr. Thomson's and my *Flora Indica* (*see* footnote p. 1). In that work three* primary divisions are recognised, namely, I. Hindustān, including the Western Peninsula from the base of the Himālaya to Cape Comorin; II. The Himālaya; III. India beyond the Ganges. These primary divisions are subdivided into 64 Provinces, the botanical characters of which, as far as they were then known, were delimited in relation to their climate, geographical position, elevation above the sea, and other physical conditions; to which are added references to many of the botanists who had explored them, their collections and their works. These 64 Provinces will, I believe, all prove to be deserving of detailed botanical treatment when sufficient materials shall have been obtained to effect this. The following is a list of them arranged under the Provinces adopted in this sketch.

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* A fourth is devoted to Afghānistān and Baluchistān, which countries not being in British India are not included in this Sketch, except a small area in Baluchistān since acquired. *See* Appendix, p. 54.

1. Eastern Himālaya. Mishmi, Abor, Bhutan, Sikkim, Central Nepāl.

2. Western Himālaya. Under three groups; I. Kumaun, Garhwāl, Simla, Kulu, Chamba, Jamu, Rajaori; II. Kunawar, Lahul, Kishtwar, Kashmir, Murree; III. Gugi, Piti and Parang, Zanskar, Dras, Nari, Ladākh, Bālti, Nubra.

3. Indus Plain, which includes the Punjab, Sind, Cutch, Gujarāt, and Rājputāna west of the Aravalli Hills.

4. Gangetic Plain under two groups. I. Upper, including Rājputāna east of the Aravalli hills, Bundelkhand, and Mālwā north of the Vindhya range. II. Lower, including Bengal, Orissa north of the Mahānadi, the Assam Plain, Sylhet, Cachar, and Tippera.

5. Malabar, including Khāndesh, the Konkan, Kanara, Malabar proper, Travancore.

6. The Deccan, including Mālwā, Behar, Berar, Central India, the Central Provinces, Chota Nagpur, Orissa south of the Mahānadi, the Deccan proper, Mysore and the Coromandel coast.

7. Ceylon.

8. Burma, including Assam, the Garo, Naga and Khasia Hills, Cachar and Sylhet, Chittagong, Tippera, Arakan, Pegu and Tenasserim.

9. The Malayan Peninsula, including the British and Siamese States therein.

I. THE EASTERN HIMĀLAYAN PROVINCE. (*See* p. 7).

The only botanically well known portion of this Province is its western, Sikkim, an oblong section of the Himālaya about 100 miles long from north to south, and 40 from east to west. An analysis of its Flora may be presumed to give an adequate idea of the general features of the unexplored Himālaya to the eastward of it. This is indeed proved by such materials as have been procured from the latter.*

A comparison of its vegetation with that of the Western Himālaya will be found under that Province.

Sikkim is the most humid district in the whole range of the Himālaya, because of its proximity to the Bay of Bengal and direct exposure to the effects of the moisture-laden south-west monsoon, from which the ranges east of Sikkim are partially screened by the mountains on the south flank of the Assam valley. It is estimated to contain about 4,000 species of Flowering plants under 160 Natural Orders; also 250 Ferns and their allies, of which eight are Tree-ferns. The 10 dominant Orders are the following, to which are appended, in brackets, their relative places in the Western Himālayan decad :—

1. *Orchideæ* (7).
2. *Gramineæ* (1).
3. *Leguminosæ* (3).
4. *Compositæ* (2).
5. *Cyperaceæ* (5).
6. *Urticaceæ*.
7. *Scrophularineæ* (10).
8. *Rosaceæ* (8).
9. *Rubiaceæ*.
10. *Euphorbiaceæ*.

The proportion of Monocotyledons to Dicotyledons in Sikkim is about 1 to 2·5. Its flora is disposed in three altitudinal zones, tropical, temperate, and alpine. It is difficult to limit, even approximately, the elevation of these zones above the sea, many tropical species ascending far into the temperate and temperate species descending into the tropical. So too with the alpine zone, many of its species descend far into the temperate, and temperate species ascend far into the alpine. Assuming the normal tropical flora to ascend from the level of the plains of

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* Of the flora of the Mishmi hills the only account is that of Griffith, who visited them in October to December, 1836, collecting upwards of 900 species of Flowering plants and 224 of Ferns and their allies. According to a list which he drew up and which is published in his "Posthumous Papers" (vol. i., p. 57, Calcutta, 1847), the following is a decad of the largest Natural Orders, with the number of species in each: 1. *Compositæ*, 80; 2. *Gramineæ*, 73; 3. *Labiatæ*, 50; 4. *Orchideæ*, 43; 5. *Rubiaceæ*, 42; 6. *Acanthaceæ*, 38; 7. *Leguminosæ*, 31; 8. *Cyperaceæ*, 22; 9. *Gesneraceæ*, 22; 10. *Euphorbiaceæ*, 21. Most of these are presumably from the tropical zone. The predominance of *Compositæ* is notable. It was during this visit that Griffith discovered the remarkable stemless and leafless root-parasite *Sapria himalayana*, a near ally of *Rafflesia Arnoldi*, which adds the Natural Order *Cytinaceæ* to the Indian Flora. It has not since been collected.

India to 6,500 feet, and the normal alpine to descend from 18,000 to 12,000, the number of species normal to each zone may possibly be found to approximate to 2,000, 1,500, and 500. The total number of recorded species of Orchids in Sikkim is 440; of Palms, 20; of *Bambuseæ*, about 23; and of Ferns and their allies, 280, of which eight are Tree-ferns.

Tropical zone of Sikkim.—This is skirted at its base by a low belt about 20 miles broad, which gradually slopes upwards from the level of the plains of Bengal to the foot-hills of the zone at 1,000 feet elevation, from which the ascent is rapid to 6,500 feet and upwards. This belt was, when Sikkim was first botanically explored (in 1848), a deadly, unhealthy Terai, covered with a loose forest (now for the most part cleared away) of trees common in the hotter parts of India, especially the Leguminous, together with the Sāl (*Shorea robusta*), a rich undergrowth of shrubs, coarse grasses, and the herbaceous plants of the Gangetic plain. Amongst them a few species of the temperate zone occur, brought down by the streams from higher levels. The foot-hills and spurs of the tropical zone are (or were before the introduction of tea cultivation) clothed throughout with a dense forest, Malayan in general character. The 10 dominant Orders of the tropical zone are, in numerical sequence:—

1. *Orchideæ.*
2. *Leguminosæ.*
3. *Gramineæ.*
4. *Urticaceæ.*
5. *Euphorbiaceæ.*
6. *Cyperaceæ.*
7. *Rubiaceæ.*
8. *Compositæ.*
9. *Asclepiadeæ.*
10. *Acanthaceæ.*

There are in this zone about 850 trees and shrubs, many of them timber-trees, amongst the most conspicuous of which are species of *Magnoliaceæ*, *Anonaceæ*, *Guttiferæ*, *Sterculiaceæ*, *Tiliaceæ*, *Meliaceæ*, *Sapindaceæ*, *Anacardiaceæ*, *Leguminosæ*, *Combretaceæ*, *Myrtaceæ*, *Lythraceae*, *Rubiaceæ*, *Bignoniaceæ*, *Laurineæ*, *Euphorbiaceæ*, *Urticaceæ*, and *Myristicaceæ*.

There are four species of Oak, as many of *Castanopsis* (a genus allied to *Castanea*), a Poplar, a Willow (*Salix tetrasperma*), one Pine (*P. longifolia*), a *Cycas* and two species of *Musa*, 18 indigenous Palms, a dwarf and a tall *Pandanus*, and 12 arborescent or frutescent Bamboos. Ferns abound. Of shrubs *Acanthaceæ* and *Melastomaceæ*, together with others of the above arboreous Orders, are amongst the most frequent. Of climbers there are many species of *Ampelideæ*, *Cucurbitaceæ*, *Convolvulaceæ*, *Apocyneæ*, *Asclepiadeæ*, *Smilax*, *Dioscorea*, and *Aroideæ*. Herbaceous plants are well represented by *Malvaceæ*, Balsams, Orchids and *Scitamineæ*, together with many species of other ubiquitous tropical Indian Orders.

The Temperate zone of Sikkim, from 6,500 to 11,500 feet, is roughly divisible into a lower non-coniferous and an upper coniferous and Rhododendron belt; but the line of demarcation between these varies so greatly with the exposure and humidity of the locality that they cannot be dealt with apart. Of about 100 Natural Orders of Flowering plants that occur in this zone the following 10 dominate, the figure in brackets after each Order denoting its relative position in the tropical zone :—

1. *Orchideæ* (1)
2. *Compositæ* (8).
3. *Gramineæ* (3).
4. *Rosaceæ*.
5. *Cyperaceæ* (6).
6. *Geraniaceæ*.
7. *Ericaceæ*.
8. *Liliaceæ*.
9. *Labiatæ*.
10. *Umbelliferæ*.

Of the above Orders the *Orchideæ* alone are strongly Malayan in character, the others are mostly European, Central Asian, Japanese or Chinese. The most conspicuous trees are *Magnoliaceæ* (five species), of which one, *Magnolia Campbellii*, before the destruction of the forests, clothed the slopes around Darjeeling, starring them in spring, when still leafless, with its magnificent flowers. Other conspicuous trees of this region are Oaks, Laurels, Maples, Birches, Alder, *Bucklandia*, *Pyrus* and Conifers. Of these the Conifers are chiefly confined to a belt from 9,000 to 12,000 feet in elevation. The monarch and most common of them is a Silver fir (*Abies Webbiana*), which is also the most gregarious; others are the English Yew, a Spruce (*Picea Morinda*), a Larch (*Larix Griffithiana*, the only deciduous Conifer in the Himālaya), the weeping *Tsuga Brunoniana*, and two species of Juniper, both of which, in dwarf forms, ascend high in the Alpine zone. The absence of any true Pine or Cypress in the forests of this region of the Himālaya is notable, in contrast with similar elevations in the Western Himālaya. Of shrubs the most conspicuous are the Rhododendrons (25 species), which abound between 9,000 and 12,000 feet elevation, some of them forming impenetrable thickets;

a few of these are arboreous, though never attaining any considerable height. Other shrubs are species of *Clematis*, *Ternstrœmiaceæ*, *Berberideæ*, *Ilex*, *Rosa*, *Rubus*, *Cotoneaster*, *Spiraea*, *Hydrangea*, *Aucuba*, *Lonicera*, *Leycesteria*, *Osmanthus*, *Osbeckia*, *Luculia*, *Buddleia*, *Vacciniaceaæ* (some epiphytic), *Ericaceæ*, Elder, *Viburnum*, *Polygonum*, Ivy, &c. Beautiful herbaceous plants abound—Anemones, Aconites, Violets, many species of Balsam, *Potentilla*, *Fragaria*, *Gentianeæ*, *Campanulaceæ*, *Gesneraceæ*, *Scrophularineæ*, *Orchideæ* (*Coelogyne*, 8 species), *Cypripedium*, *Polygonatum*, *Smilacina*, *Lilium*, *Fritillaria*, *Arisæma*. Only two Palms inhabit this zone, a scandent rattan (*Plectocomia himalaica*), and very rarely a Fan-palm (*Trachycarpus Martiana*). Dwarf bamboos, of which there are six species, abound, some of them forming impervious thickets infested with leeches and large ticks. Ferns are characteristic of this zone.

The Alpine zone of Sikkim descends to about 12,000 feet from the upper limit of the existence of flowering plants. It presents two climates with conforming differences in their vegetation; a lower or outer humid, and an upper or inner dry Tibetan region. But the limits of these climates are not clearly defineable either topographically or botanically; for whereas in some cases the passes between Sikkim and Tibet are abrupt and lofty, in others the valleys expand widely and become gradually Tibetan in climate and features, the pass proper being a political boundary. Further, some valleys run up from south to north, others from west to east. The number of species of flowering plants recorded for this zone is about 380, no doubt far below what future collectors will raise it to. They are included under 46 Orders, of which the 10 dominant are as follows, their corresponding position in the Western Himālayan decad, being given in brackets.

1. *Compositæ* (1).
2. *Scrophularineæ*.
3. *Primulaceæ*.
4. *Saxifragaceæ* (9).
5. *Cruciferæ* (5).
6. *Caryophylleæ* (8).
7. *Ranunculaceæ* (6).
8. *Cyperaceæ* (4).
9. *Gramineæ* (2).
10. *Fumariaceæ* (10).

Of the above the first three greatly outnumber the others, some of which may have to give place to *Rosaceæ*, *Gentianaceæ*, or *Umbelliferæ*. The largest genera are *Pedicularis*, *Primula*, *Corydalis* and *Saxifraga*. The low position of

Cyperaceæ and *Gramineæ* in the decad is notable, remarkably so in contrast to the Western Himālayan decad; but future herborizations may bring them up higher. The few trees to be found on the lower skirts only of this zone are scattered Birches and *Pyri*. The principal bushes are Rhododendrons (of which several species attain 14,000 feet elevation, and three dwarf ones 16,000 feet), two junipers, species of *Ephedra*, *Berberis*, *Lonicera*, *Caragana*, *Rosa*, *Cotoneaster*, *Spiraea* and dwarf Willows. Of ferns there are very few. About 30 species reach 18,000 feet elevation, some of them a little higher. The highest recorded plant is a *Festuca* (not found in flower) at about 18,300 feet. In drier valleys above 15,000 feet elevation several species of *Arenaria* occur, which form hard, hemispheric or globose white balls and are a characteristic feature in the desolate landscape. By far the most striking plants of this zone are the species of *Meconopsis*, *Rheum nobile*, the Edelweiss, many Primulas, *Tanacetum gossypinum*, *Saussurea obvallata* and *gossypifera*, and the odorous *Rhododendron Anthopogon*.

II.—THE WESTERN HIMĀLAYAN PROVINCE. (*See* p. 7.)

The Western Himālayan ranges differ greatly from the Eastern, in orientation, in greater length, higher latitude, cooler drier climate, and in the far greater breadth of the mountain mass west of the Sutlej. A transverse section drawn through the valley of Kashmir, from the plain of the Punjab to the Karakoram range, is three times as long as one drawn anywhere transversely across the Eastern Himālaya, and unlike the latter, it presents a series of parallel snow-clad ranges, which have a general direction from S.W. to N.E. Of the valleys enclosed by these ranges, those towards the plains are very narrow, tortuous and steep; the rearward, on the contrary, are more open, with more elevated, often saline floors, and owing to the dryness of the air are either sterile or support a Tibetan vegetation. The latter valleys constitute Little Tibet, forming the western termination of the Great Tibetan plateau. It would appear from the above that the Western Himālaya should greatly outnumber the Eastern in genera and species, and but for the dryness and reduced temperature of its tropical and temperate zones it would doubtless do so. But if it is borne in mind that no area in the Western Province of the dimensions of Sikkim is nearly so rich as the latter, and that the Flora of the Western is fairly well explored, while the Eastern, except in Sikkim, is all but unexplored, the conclusion must be that the latter will prove to be far the richer botanically.

Upwards of 4,000 Flowering plants are recorded as Western Himālayan, comprised in 147[*] Natural Orders, and there are also 230 Ferns and their allies. Of the former, the following 10 are the dominant ; the number in brackets indicating their corresponding positions in the decad of Eastern Himālayan :—

1. *Gramineæ* (2).
2. *Compositæ* (4).
3. *Leguminosæ* (3).
4. *Cyperaceæ* (5).
5. *Labiatæ*.
6. *Ranunculaceæ*.
7. *Orchideæ* (1).
8. *Cruciferæ*.
9. *Rosaceæ* (8).
10. *Scrophulariaceæ* (7).

The proportion of Monocotyledons to Dicotyledons is about 1–3. Twelve Eastern Himālayan Orders here disappear, viz., *Dilleniaceæ*, *Guttiferæ*, *Passifloraceæ*, *Stylidieæ*, *Vacciniaceæ*, *Diapensiaceæ*, *Myristicaceæ*, *Proteaceæ*, *Cycadeæ*, *Burmanniaceæ*, *Xyrideæ*, and *Pandaneæ*. With the exception of *Vacciniaceæ* and *Diapensiaceæ*, all are tropical. The following five Orders that are absent in the Eastern Himālaya are found in the Western : *Resedaceæ*, *Moringeæ*, *Polemoniaceæ*, *Salvadoraceæ*, *Illecebraceæ*, of which *Polemonium* alone is strictly temperate or sub-alpine. Of even greater significance is the removal of Orchids from the first to the seventh place in the above decad, and the replacement of the tropical Orders of *Urticaceæ*, *Rubiaceæ*, and *Euphorbiaceæ* of the Eastern Province by the temperate *Ranunculaceæ*, *Cruciferæ*, and *Labiatæ* of the Western. Finally, an instructive example of the difference between the Eastern and Western floras is afforded by a reference to the recently published *Flora Simlensis* by the late Colonel Sir Henry Collett. In that work, 1,326 flowering plants are described, of which nearly one-third are absent in Sikkim. The number of genera in the Western Himālayan Province (about 1,220) does not greatly exceed that in Sikkim, but no fewer than 250 of them are absent from the latter; almost all of them are European, thus demonstrating the preponderance of this element in the West. Selecting some of the most conspicuous of the typically European Orders common to the Eastern and Western Himālaya, and indicating by the letters E. and W. a rough approximation to the relative number of species under each, the following are the results :—

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[*] The Order *Platanaceæ* is excluded, the Oriental Plane not being indigenous in any part of India.

Cruciferæ $\frac{W.\ 40}{E.\ 18}$, *Caryophylleæ* $\frac{W.\ 19}{E.\ 11}$, *Umbelliferæ* $\frac{W.\ 23}{E.\ 15}$,
Compositæ $\frac{W.\ 104}{E.\ 57}$, *Boragineæ* $\frac{W.\ 76}{E.\ 25}$, *Labiatæ* $\frac{W.\ 48}{E.\ 35}$,
*Chenopodiaceæ** $\frac{W.\ 18}{E.\ 3}$, *Gramineæ* $\frac{W.\ 100}{E.\ 72}$.

About 170 species of Orchids are recorded as West Himālayan most of them being terrestrial, but few are of tropical type; a list of such as are European is given at p. 6, in a foot-note. Of Palms there are 6 species; of *Bambuseæ* 7.

Tropical zone of the Western Himālaya.—The upper limit of this zone is lower by perhaps 1,000 feet than is that of the corresponding zone in Sikkim. Notwithstanding the absence of the above-mentioned tropical Orders its general features are the same in both Provinces. Proceeding north-westward, however, tropical species rapidly decrease in numbers and in the extreme west, in Chitrāl, the tropical zone disappears. As examples of this dying out of tropical types in the west the following fifteen are instructive, in which the letters E. and W. denote the two contrasted zones :—

Menispermaceæ $\frac{E.\ 13}{W.\ 6}$, *Sterculiaceæ* $\frac{E.\ 22}{W.\ 15}$, *Liliaceæ* $\frac{E.\ 28}{W.\ 16}$,
Meliaceæ $\frac{E.\ 14}{W.\ 6}$, *Ampelideæ* $\frac{E.\ 37}{W.\ 19}$, *Araliaceæ* $\frac{E.\ 21}{W.\ 10}$,
Begoniaceæ $\frac{E.\ 16}{W.\ 2}$, *Myrsineæ* $\frac{E.\ 18}{W.\ 8}$, *Gesneraceæ* $\frac{E.\ 32}{W.\ 9}$,
Piperaceæ $\frac{E.\ 11}{W.\ 5}$, *Laurineæ* $\frac{E.\ 44}{W.\ 14}$, *Urticaceæ* $\frac{E.\ 110}{W.\ 65}$,
Commelynaceæ $\frac{E.\ 22}{W.\ 9}$, *Palmeæ* $\frac{E.\ 20}{W.\ 6}$, *Bambuseæ* $\frac{E.\ 17}{W.\ 7}$.

Amongst the most interesting tropical and sub-tropical trees and shrubs of the Western Himālaya that are absent in the Eastern are *Cocculus laurifolius*, *Boswellia thurifera*, *Pistacia integerrima*, the Pomegranate and Oleander, *Roylea elegans*, *Engelhardtia Colebrookeana*, and *Holoptelea integrifolia*, most of which are also Oriental.

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* The absence of saline soil in Sikkim accounts for its poverty in this Order.

The Orchids of this zone, especially the epiphytic, are few and almost confined to the districts of Kumaun and Garhwāl. There are only 15 Dendrobes, all but one or two of which are also natives of Sikkim, where about 40 are known. Of *Bulbophyllum* and *Cirrhopetalum* only six species are recorded. The Palms are *Wallichia densiflora*, *Phœnix sylvestris*, *acaulis* and *humilis*, *Nannorhops Ritchieana* and *Calamus tenuis*. The only common Bamboo is *Dendrocalamus strictus*.

Temperate zone of the Western Himālaya.—Owing to the complexity of the mountain ranges, outer and inner, and the differences of their climates, it is very difficult to assign altitudinal limits to this zone. In Kumaun and Garhwāl I have estimated it as perhaps 1,000 feet lower than in Sikkim, but further to the west and north observations are wanting for fixing it. The vegetation of the outer ranges is in character on the whole that of Sikkim, the difference being due mainly to the greatly increased number of European genera. All the Conifers of the Eastern Himālaya are present, except the Larch, and to these are added forests of Deodar, *Pinus longifolia*, (a comparatively rare plant in Sikkim and there only tropical) *Abies Pindrow*, *Cupressus torulosa*, *Juniperus macropoda* and (in dry regions) *Pinus Gerardiana ;* the first and three last giving, where found, a character to the landscape. Of Oaks there are six, four of them Sikkim species, two only being western, of which one is the European Holm Oak (*Quercus Ilex*), which extends eastward to Kumaun at 3,000 to 8,500 feet elevation, and westward to Spain. The Indian Horse-Chestnut, *Æsculus indica*, represents the eastern *Æ. punduana*. Two Birches and two Hornbeams are common to both regions, but the eastern nut, *Corylus ferox*, is replaced by the Oriental *C. Colurna*.

Amongst other shrubs and small trees peculiar to the Western Himālaya are the Indian Bladder-nut and Lilac (*Staphylea Emodi* and *Syringa Emodi*), *Rosa Webbiana*, *moschata* and *Eglanteria*, *Parrottia Jacquemontiana*, the Mountain Ash (*Pyrus Aucuparia*), the Bullace (*Prunus insititia*), and the common Hawthorn. On the other hand, the most striking difference between the temperate Floras of Eastern and Western Himālaya is the paucity of species of *Rhododendron* in the latter, where only four are found, all common in Sikkim

R. Anthopogon, *barbatum*, *campanulatum*, and *arboreum*; the latter also inhabits the mountains of southern Malabar, Burma and Ceylon. Of European herbaceous plants there occur several hundreds unknown in Sikkim, as *Nymphæa alba*, *Lythrum Salicaria*, *Caltha palustris*, *Ranunculus aquatilis*, and *R. Lingua*, which all occur in the lake of Kashmir; also species of *Aquilegia* and *Pæonia*, *Parnassia palustris*, *Adoxa Moschatellina*, *Polemonium cæruleum*, *Eriophorum vaginatum*, and many Grasses, Rushes and *Carices*. The genus *Impatiens* abounds in the temperate zone, at all elevations, except the highest, the species being with few exceptions endemic. The Orchids of this zone are almost uniformly terrestrial; they include several European species unknown in the Eastern Himālaya, as *Corallorhiza innata*, *Epipogum aphyllum*, *Listera ovata* and *cordata*, *Orchis latifolia*, and *Habenaria viridis*. The only Palm is *Trachycarpus Martiana*, confined to and rare in Kumaun and Garhwāl, but also a Sikkim plant. Of Bamboos there are four, all dwarf and gregarious.

Alpine zone of the Western Himālaya.—Assuming 11–12,000 ft. as the lower limit of this zone in the outer ranges and 18,000 feet as the normal upper limit of flowering plants, about 600 species belonging to 48 Natural Orders are recorded as indigenous. Of these Orders the dominant ten are the following, with their relative positions in the Alpine Sikkim decad indicated in brackets:—

1. *Compositæ* (1).
2. *Gramineæ* (9).
3. *Leguminosæ*.
4. *Cyperaceæ* (3).
5. *Cruciferæ* (5).
6. *Ranunculaceæ* (7).
7. *Gentianeæ*.
8. *Caryophylleæ* (6).
9. *Saxifragaceæ* (4).
10. *Fumariaceæ* (10).

Two Orders of the above decad, *Leguminosæ* and *Gentianeæ*, are absent in the corresponding Eastern one, where they are replaced by *Primulaceæ* and *Scrophularineæ*. I doubt, however, this and other comparisons holding good when Alpine Sikkim shall have been fully explored. As was to be expected, the Western Alpine Flora is much richer than the Eastern, due to its greater area. The increment consists mainly of small European genera, and not in additions to the large genera common to both; for taking 29 of the latter, the sum of their species is nearly the same for both Provinces, 277 in the Eastern, 266 in the Western; the close coincidence is of course accidental, but not the less instructive.

The genera in excess in the Eastern are:—

Arenaria $\frac{\text{E. 10}}{\text{W. 7}}$, *Saxifraga* $\frac{\text{E. 25}}{\text{W. 18}}$, *Primula* $\frac{\text{E. 24}}{\text{W. 11}}$,
Rhododendron $\frac{\text{E. 10}}{\text{W. 2}}$, *Pedicularis* $\frac{\text{E. 40}}{\text{W. 18}}$.

In excess in the Western Himālaya are:—

Astragalus $\frac{\text{E. 6}}{\text{W. 22}}$, *Caragana* $\frac{\text{E. 1}}{\text{W. 6}}$, *Tanacetum* $\frac{\text{E. 2}}{\text{W. 8}}$,
Artemisia $\frac{\text{E. 4}}{\text{W. 11}}$, *Saussurea* $\frac{\text{E. 13}}{\text{W. 20}}$, *Nepeta* $\frac{\text{E. 2}}{\text{W. 7}}$,
Polygonum $\frac{\text{E. 7}}{\text{W. 16}}$.

In the following large genera the numbers in each Flora are nearly equal, *Corydalis*, *Draba*, *Potentilla*, *Gentiana*, *Juncus*, *Carex*. The above data all point to a further great predominance of the Eastern Himālayan Alpine Flora over the Western to be expected when the 500 miles of mountains east of Sikkim shall have been botanized.

Two of the most conspicuous alpine plants of Sikkim are absent in the Western Himālaya, *Rheum nobile* and *Tanacetum gossypinum*; the latter has, however, the remarkable *Saussurea obvallata* and *gossypiphora*, together with, in the driest regions, some cushion-formed species of *Arenaria*.

*Tibetan valleys of the Western Himālaya.**—Ascending the Indus river a few tropical plants extend up to Gilgit (alt. 4–5,000 feet). At greater elevations the full effects are experienced of a dry climate, great cold alternating with fierce sun-heat, and consequent aridity. Between 12,000 and 14,000 feet the principal indigenous trees are *Populus euphratica* and *P. balsamifera*, and of shrubs or small trees *Ulmus parvifolia* and species of *Tamarix*, *Caragana*, *Rosa*, *Lonicera*, *Hippophae*, *Myricaria*, *Elaeagnus*, and *Salix*. The cultivated trees are the fruit-bearing European ones, with *Populus alba* and *P. nigra*. Above 14,000 feet and up to 18,000, is a region of alpine perennials of European, Oriental, and Central Asian Orders and Genera, as *Fumariaceæ*, *Leguminosæ* (*Astragalus* especially), *Compositæ*, *Labiatæ* and

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* The only botanist who has written on the distribution of the plants of this region is the late Dr. Thomas Thomson, F.R.S., who explored it in 1847 and 1848. See *Narrative of a Journey in the Western Himalaya and Tibet* (1852), and Introductory Essay to the *Flora Indica* (1855).

Stipaceæ. The only Orchids are a few species of *Orchis* and *Herminium.* Above 17,000 feet, 25 genera are recorded, all (except *Biebersteinia*) European, and many of them British, as *Potentilla Sibbaldi* and *anserina, Saxifraga cernua, Lloydia serotina.* The most typical plant of this region is *Arenaria rupicola,* which forms hard white cushions or balls a foot in diameter, apparently the growth of centuries. The genera *Astragalus, Saussurea, Artemisia, Tanacetum,* and *Allardia,* have many endemic species at these elevations. Where saline soils occur *Chenopodiaceæ* abound, with two endemic Crucifers (*Dilophia* and *Christolea*), also *Sonchus maritimus, Glaux maritima* and *Triglochin maritimum.* The Fresh-water plants of this region include *Ranunculus aquatilis, Hippuris vulgaris, Limosella aquatica,* and species of *Utricularia, Potamogeton* and *Zannichellia.* Ferns are all but absent.

III.—The Indus-plain Province. (*See* p. 7.)

Whether proceeding across this Province in a S.W. direction from the Himālaya to Sind, or in a S.E. from the Afghan border to Western Rājputāna, vegetation rapidly diminishes, approaching extinction in the Indian desert. Over the whole province a low, chiefly herbaceous, vegetation of plants common to most parts of India, mixed with Oriental, African and European types, is spread, with thickets of shrubs and a few trees, the latter most luxuriant along the banks of the rivers. With few exceptions all are leafless and the herbaceous species dry up in the hot season.

Taking into account the forest trees on the northern borders and some immigrants from the hills carried down by streams, the Flora of this Province may number about 1,500 indigenous species, under 112 Orders, of which the following are the dominant ten:—

1. *Gramineæ.*
2. *Leguminosæ.*
3. *Compositæ.*
4. *Cyperaceæ.*
5. *Scrophularineæ.*
6. *Labiatæ.*
7. *Boragineæ.*
8. *Malvaceæ.*
9. *Euphorbiaceæ.*
10. *Convolvulaceæ.*

Of the 112 Orders, 33 are represented by a single genus only and 13 of them by a single species. The chief arboreous vegetation consists of isolated groups of trees on the outskirts of the Western

Himālayan Province, on the banks of the rivers and on the western flank of the Aravalli hills. Of the first, the best example occurs at Hoshiarpur, which borders upon the Himālayan district of Chamba; in it the Sāl finds its extreme western limit, together with a species of *Englehardtia* and *Pinus longifolia.* The forest on the W. flank of the Aravalli hills is a continuance of the Ajmir[*] forest, which is more fully developed on the east flank of this same range,—that is in the Gangetic Plain Province. The principal trees of the Indus Plain are *Bombax malabaricum, Sterculia urens, Moringa pterygosperma* and *concanensis, Boswellia serrata, Odina Wodier, Ægle Marmelos, Balsamodendron Mukul* and *pubescens, Pistacia integerrima, Prosopis spicigera, Acacia arabica, rupestris, leucophlæa* and *Jacquemontii, Dichrostachys cinerea, Bauhinia purpurea,* species of *Dalbergia* and *Mimosa, Anogeissus pendula, Cordia Myxa* and *Rothii, Tamarix articulata* and *Populus euphratica*[†]; this last abounds along the river banks with *Salix tetrasperma* and *S. acmophylla. Dendrocalamus strictus* is the only Bamboo. The only Palms are scattered specimens of *Phoenix sylvestris,* and in the Salt Range and Sind the remarkable semi-prostrate gregarious fan-leaved Palm *Nannorhops Ritchieana.*

Of Shrubs the most conspicuous are isolated clumps of the succulent all but leafless columnar *Euphorbia Royleana* and *neriifolia.* Other prevalent shrubs are species of *Capparideæ* and of *Zizyphus, Grewia, Balanites aegyptiaca, Calotropis, Alhagi maurorum, Pluchea lanceolata, Fagonia arabica, Cassia auriculata, Tora* and *obovata, Dodonaea viscosa, Tecoma undulata, Rhazya stricta, Calligonum polygonoides*; and, west of the Indus only, *Reptonia buxifolia, Gossypium Stocksii* (the only indigenous cotton of the Old World), confined to Sind, as is *Pteropyrum Olivieri.* Of scandent plants the commonest are *Ephedra Alte, Periploca aphylla, Cassytha filiformis* and *Cuscuta reflexa* and *parvifolia.* The herbaceous vegetation includes plants of all the Orders of the decad, with others of *Cruciferæ*, *Resedaceæ*, *Caryophylleæ*, *Zygophylleæ*, *Ficoideæ*, *Cucurbitaceæ*, *Plantagineæ*, *Amarantaceæ*, *Chenopodiaceæ* and *Polygoneæ*. Grasses are numerous and conspicuous, especially the odorous *Andropogon Irawancusa* and *A. Nardus*, and the inodorous *A. squarrosus*. The curious Rosaceous plant *Neurada procumbens* is confined to this Province, and the widely spread European and Oriental *Frankenia pulverulenta* and *Herniaria hirsuta* advance very little to the eastward of it. The Persian *Seetzenia orientalis* is in India confined to Sind. The only Orchid is the diminutive terrestrial widely spread *Zeuxine sulcata*.

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[*] For an excellent account of the Flora of Rājputāna, to which I am greatly indebted, *see* Sir George King, in the *Indian Forester.*

[†] In India this widely spread Central Asian tree is confined to the plain of this Province and elevations up to 10,000 feet in the Tibetan Himālaya, whence it extends over Central Asia.

The vegetation of the Indus delta is, like that of the Sundarbans of Bengal, estuarial, and of the same character, with the important exceptions of being much poorer in species and wanting in the two Palms *Nipa fruticans* and *Phoenix paludosa*. It has, however, the remarkable tall grass *Oryza coarctata*, which is confined to the two deltas. On Mount Abu, a solitary hill 5,653 feet in elevation, in the S.E. of this Province, more humid tropical types appear, with *Rosa involucrata*, *Vogelia indica*, and an epiphytic Orchid (*Ærides*). Many cultivated fruits also succeed in the villages, such as the Mulberry, Tamarind, Mango, Guava and Custard Apple.

Ferns are exceedingly rare in this Province; 5 are found rather widely spread in the dry districts, namely, *Nephrodium molle*, *Adiantum caudatum*, and *A. Capillus-Veneris*, and *Actinopteris radiata*, together with (on Mount Abu only) *Nephrodium cicutarium*, *Cheilanthes farinosa*, *Botrychium virginianum*, and *Adiantum lunulatum*.

IV.—THE GANGETIC PLAIN PROVINCE. (*See* p. 7.)

This Province presents three assemblages of plants which may be regarded as botanical Sub-provinces; I. the dry upper valley from E. Rājputāna to the Kosi river, that is a little above the bend of the Ganges at Rājmahāl; II. Bengal proper of the old maps, defined* as "the humid region of the Gangetic delta and the region immediately north of it." This Sub-province includes the Assam plain and a coast strip of Orissa, as far as the Mahānadi River. III. the Sundarbans.

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* This is the definition of Bengal adopted in Yule and Burnell's Anglo-Indian Glossary. Politically, Bengal includes Sikkim on the north, Orissa, Behar and Chota Nagpur on the south and west, and Chittagong and Tippera on the east. Of this region (excluding Sikkim), a Flora by Major Prain has just been prepared, but is not yet published.

The number of indigenous species in this Province is small, possibly amounting to 1,500, under 112 Orders, of which the following 10 are dominant; the attached numbers in brackets are those of the corresponding decad in the Indus-Plain Province:—

1. *Gramineæ* (1).
2. *Leguminosæ* (2).
3. *Cyperaceæ* (4).
4. *Compositæ* (3).
5. *Scrophularineæ* (5).
6. *Malvaceæ* (8).
7. *Acanthaceæ*.
8. *Euphorbiaceæ* (9).
9. *Convolvulaceæ* (10).
10. *Labiatæ* (6).

The only other Orders rich in genera and species are *Cucurbitaceæ*, *Asclepiadeæ*, *Verbenaceæ*, and *Amarantaceæ*. The largest genera are *Hibiscus*, *Indigofera*, *Crotalaria*, *Ipomæa*, *Polygonum*, *Cyperus*, *Fimbristylis*, *Panicum*, *Andropogon*, and *Eragrostis*; *Gymnospermæ* and *Cupuliferæ* are absent; and the European Orders *Ranunculaceæ*, *Cruciferæ*, *Caryophylleæ*, *Geraniaceæ*, *Rosaceæ*, *Saxifragaceæ*, *Campanulaccæ*, and *Gentianeæ* are very scantily represented, chiefly by annual weeds.

Upper Gangetic plain.—The indigenous vegetation of the upper part of this Sub-province is that of a dry country, the trees in the dry season being leafless (for the most part) and the grasses and other herbs burnt up; but by far the greater part of the land to the eastward contrasts with that to the westward in being under cultivation. In the extreme west, the Flora is continuous with that of the Indus Plain, and might perhaps be better included in that Province, *Peganum Harmala*, *Pluchea lanceolata*, *Tecoma undulata*, and other plants characteristic of the Punjab being equally so of the western part of this Sub-province. These gradually disappear in following the course of the river downwards into a more humid climate, and towards the entrance of the Kosi river they are replaced by the plants typical of Bengal proper. The principal forest is that of Ajmir, flanking the Aravalli and other hills which bound the Sub-province on the west. The most characteristic tree of this forest is *Anogeissus pendula;* others more or less restricted to western India are *Boswellia serrata*, *Balsamodendron Mukul* (which is rare), *Moringa pterygosperma*, *Rhus mysorensis*, *Acacia Senegal* and *Prosopis spicigera*, accompanicd by the common trees of the drier parts of India. The Bengal rose, (*Rosa involucrata*) occurs frequently, forming an erect bush in the open, and seeming to an English eye to be quite out of place in its climate and its surroundings; it has a very narrow but extended range in northern India, from Mount Abu in Rājputāna to Burma. Several British herbaceous plants are common, flowering in the cool season, especially *Ranunculus sceleratus*, *Malva rotundifolia*, *Lotus corniculatus*, *Lathyrus Aphaca*, *Anagallis arvensis* and *Veronica agrestis*. *Dendrocalamus strictus* and *Bambusa Balcooa* are the only indigenous Bamboos, and are natives of the bordering hills rather than of the plain. The cultivated *Phœnix* and *Borassus* are the two Palms most commonly seen, but two species of rattan (*Calamus*) are found in thickets. Considerable areas of this Sub-province are occupied by the Usar, or Reh-lands, which, being impregnated with alkalis, converted into swamps in the rainy season and into deserts in the dry, are as unfavourable to a native as they are to an introduced vegetation. *Salvadora persica* is said to be the only tree that will succeed on the most saline of them, and of herbaceous plants a few perennial-rooted grasses are the only ones which thrive.

Bengal proper, by its humidity and luxuriant evergreen vegetation, contrasts favourably with the upper valley of the Ganges. The villages are usually buried in groves of Mango, Figs, and Bamboos, with the Betel-nut Palm, Palmyra, Phœnix, and Coco-nut. The trees are of many kinds, and it is difficult to distinguish the indigenous from the introduced. Except perhaps a few *Fici*, the most common belong to the latter class. Such are *Michelia Champaca*, *Polyalthia longifolia*, *Bombax malabaricum*, *Eriodendron anfractuosum*, *Lagerstrœmia Regina*, *Pterospermum acerifolium*, with species of *Terminalia* and *Artocarpus*. The shrubby and herbaceous vegetations are for the most part of species found all over India. In the *jhil* district in the east, where the waters of the great rivers Ganges, Brāhmaputra and Sūrma inosculate and overflow during the rains, aquatic and marsh plants, especially *Cyperaceæ* and tall *Gramineæ* of many kinds, prevail, but not the *Nymphæaceæ* (*Nymphæa*, *Nelumbium*, and *Euryale*), which affect stiller shallower waters. The most interesting of the water-plants of India is *Aldrovandra vesiculosa*, the curious floating Fly-trap mentioned at p. 5. There are few Orchids and those are mostly terrestrial. The epiphytic Orchids include species of *Vanda*, *Luisia* and *Cymbidium*. *Aroideæ* abound, and are conspicuous features both wild and in cultivation; amongst the latter are broad-leaved species of *Amorphophallus*, *Alocasia*, and *Colocasia*; of the wild the most conspicuous are *Scindapsus officinalis*, clothing the trunks of trees with its magnificent foliage, and *Pothos scandens*, which simulates the Ivy in covering walls and tree trunks. The prickly *Lasia heterophylla* abounds in the marshes, and species of the curious genus *Cryptocoryne* with twisted spathes are frequent on the muddy river margins. *Pistia Stratiotes* is ubiquitous in fresh water, and several species of *Lemna* are common. An anomalous feature in the Flora of Bengal is the occurrence of a few plants typical of the Khasia hills on rising grounds between the *Jhils*. Of this the district of Mymansingh affords an example, in which may be found, together with the common plants of Bengal, a few wanderers from the hilly regions to the northward.

The Sundarbans.—The estuarial Floras* of India are notable, inasmuch as that, considering the limited areas they occupy, they contain more local species than do any other botanical regions in India. This is due to the saline properties of their waters, and to tidal action on the land. The islets of the Sundarbans are in great part clothed with a dense evergreen forest of trees and shrubs, amongst which the various Mangroves hold the first place, with an undergrowth of climbers and herbaceous plants, together with *Typhaceæ*, *Gramineæ*, and *Cyperaceæ*. Two gregarious Palms form conspicuous features, the stemless *Nipa fruticans* in the swamps and river banks with leaves 30 feet long, and the elegant *Phœnix paludosa* in drier localities; as do the cultivated Coco-nut and Betel-nut palms. The principal exceptions to these forest-clad tracts are the sand hills occurring at intervals along the coasts facing the sea, the vegetation of which differs from that of the inland muddy islets and grassy savannahs which become more frequent in advancing eastward towards the mouth of the Megna.

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* The four chief estuarial Floras of India occupy the deltas of the Ganges, Irrawaddy, Mahānadi and Indus, but minor ones occur at intervals commonly along the eastern shores of the Indian Ocean, more rarely on the western.

Three hundred indigenous species of flowering plants, under 72 Orders, and 17 Ferns and their allies are comprised in the Sundarbans Flora.* Of these the dominant Orders are—

1. *Leguminosæ.*
2. *Gramineæ.*
3. *Cyperaceæ.*
4. *Euphorbiaceæ.*
5. *Orchideæ.*
6. *Compositæ.*
7. *Asclepiadeæ.*
8. *Verbenaceæ.*
9. *Convolvulaceæ.*
10.
    - *Malvaceæ.*
    - *Rubiaceæ.*
    - *Acanthaceæ.*
    - *Urticaceæ.*

A very large proportion of genera consist of a solitary species. Of the trees and shrubs one alone, *Ficus*, contains four. There are about 50 species of trees which may be classed according to whether they are purely estuarial, or common to other parts of India. Amongst the former are *Hibiscus tortuosus*, *Thespesia populnea*, *Brownlowia lanceolata*, *Amoora cucullata*, *Carapa moluccensis* and *obovata*, *Bouea burmanica*, *Erythrina indica*, *Afzelia bijuga*, *Rhizophora conjugata* and *mucronata*, *Ceriops Roxburghiana*, *Kandelia Rheedei*, *Bruguiera gymnorhiza* and *parviflora*, *Lumnitzera racemosa*, *Barringtonia racemosa*, *Sonneratia apetala* and *acida*, *Ægialitis rotundifolia*, *Ægiceras majus*, *Cerbera Odollam*, *Avicennia officinalis* and *alba*, *Excæcaria Agallocha*, *Sapium indicum*, *Casuarina equisetifolia* (doubtfully indigenous), *Nipa fruticans* and *Phœnix paludosa*; to which may be added as estuarial woody climbers *Hibiscus tiliaceus*, *Dalbergia spinosa* and *torta*, *Mucuna gigantea*, *Derris sinuata* and *uliginosa*, *Finlaysonia obovata* and *Sarcolobus globosus*; and amongst under-shrubs *Acanthus ilicifolius* and *volubilis*. Of trees common to inland Bengal there are about as many as there are purely estuarial; they include *Kleinhovia Hospita*, *Micromelum pubescens*, *Ægle Marmelos*, *Zizyphus Jujuba*, *Odina Wodier*, *Cassia Fistula*, *Pongamia glabra*, *Acacia tomentosa* and *arabica*, *Barringtonia acutangula*, *Ixora parviflora*, *Morinda bracteata*, *Diospyros montana* and *D. Embryopteris*, *Cordia Myxa*,

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* These numbers are taken from Major Prain's exhaustive article entitled "Flora of the Sundribuns," published in the *Records of the Botanical Survey of India*, vol. ii., p. 231 (June 1903), upon which I have drawn largely in the following sketch.

Dolichandrone Rheedei, *Vitex trifolia* and *V. Negundo*, *Cyclostemon assamicus*, *Croton oblongifolius*, *Antidesma Ghæsembilla*, *Trewia nudiflora*, *Streblus asper*, *Trema orientalis*, and four species of *Ficus*.

Of herbaceous plants that are purely estuarial there are few, the most remarkable of them being two tall grasses, one, *Oryza coarctata*, which grows profusely on the banks of the islets, but (except in the delta of the Indus) has been found nowhere else; the other, which forms floating masses, is *Myriostachya Wightianaa*, a native of estuaries on the E. side of the Bay of Bengal and in Ceylon.

Of aquatic plants with floating leaves *Nymphæaceæ* are entirely absent, as are *Lemnaceæ*, but *Limnanthemum cristatum* is found, and in the salt-pans on the northern limits of this Sub-province *Aldrovanda verticillata* mentioned above (p. 5). There are also a few species of *Utricularia*, *Ipomæa aquatica*, and the common *Naiadaceæ* and *Hydrocharideæ* of India. *Pistia* abounds in tanks and the fresher water districts. The Sundarbans Orchids comprise eight genera and 13 species, all epiphytic. A species of *Cirrhopetalum* alone is endemic. Of parasites there are four species of *Loranthaceæ*, a *Cuscuta* and *Cassytha*. *Bambuseæ* are entirely absent. The indigenous Palms are the above mentioned *Nipa* and *Phœnix*, and two rattans (a *Calamus* and a *Dæmonorhops*), both the latter common to Bengal.

Major Prain in his "Flora of the Sundribuns" (*see* footnote, p. 27), enumerates 35 littoral flowering plants, under 21 Orders, which, though widely distributed on other shores of India, have not been detected in this region; amongst the most common of these are *Calophyllum inophyllum*, *Heritiera littoralis*, *Suriana maritima*, *Sophora tomentosa*, *Lumnitzera coccinea*, *Pemphis acidula*, *Scævola Kœnigii*, *Pisonia* (3 sp.), *Euphorbia Atoto*, *Lepturus repens*, and *Spinifex squarrosus*.

A most remarkable character of the estuarian vegetation is the habit of several of the endemic species to send up from their subterranean roots a multitude of aerial root-suckers, in some cases several feet long, which act as respiratory organs. These suckers occur in species of *Avicennia*, *Carapa*, *Heritiera*, *Amoora*, *Sonneratia*, and in *Phœnix paludosa*.

V. and VI.—THE WESTERN PENINSULA (The Deccan and Malabar Provinces). (*See* pp. 7, 8.)

The Flora of this large portion of India, roughly bounded on the north by the Vindhya, Kaimur, and Rājmahāl hills, and extending south to Cape Comorin, comprises two very distinct botanical Provinces, a comparatively narrow western and a broad eastern ; but materials do not exist for drawing the phytogeographical boundary line between them with any approach to accuracy. This is due to the fact that the Western Province (Malabar), which is mountainous throughout (and technically called the Western Ghāts) sends, for a great part of its length, spurs across the more depressed eastern Province, carrying with them characteristic western plants. Furthermore, no complete local Flora has been published for any considerable area of the Peninsula, and over many parts no collections have been made; not even a list of the plants around the city of Madras has been published, and only a very imperfect one of the Bombay Presidency.* Before, therefore, proceeding to describe the two Provinces of Malabar and the Deccan, I shall, regarding them as one, contrast it with that of the Botanical Provinces on the eastern side of the Bay of Bengal (Burma).

Upwards of 4,000 species of flowering plants have been recorded from the whole Western Peninsula as above delimited, under about 150 Natural Orders, of which the ten dominant are here given in approximately numerical sequence, the figures in brackets indicating their corresponding position in the Burmese decad :—

1. *Gramineæ* (3).
2. *Leguminosæ* (2).
3. *Acanthaceæ* (6).
4. *Orchideæ* (1).
5. *Cyperaceæ* (7).
6. *Euphorbiaceæ* (5).
7. *Rubiaceæ* (4).
8. *Compositæ* (9).
9. *Labiatæ*.
10. *Asclepiadeæ*.†

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* Dalzell and Gibson's *Bombay Flora* (1861). A complete Flora of the Bombay Presidency is now being prepared by Dr. T. Cooke, C.I.E., F.L.S., of which one volume (*Ranunculaceæ* to *Rubiaceæ*) has been published.

† The inclusion of *Asclepiadeæ* in this decad, and the absence from it of *Scrophularineæ* are notable. Referring to the *Flora of British India*, I find about 80 species of the one and 65 of the other recorded as indigenous in the Western Peninsula. On the other hand, in a list of 1,377 flowering plants collected in Chota Nagpur, I find 38 *Scrophularineæ* and only 15 *Asclepiadeæ* (J. J. Wood in *Records of Botanical Survey of India*, vol. ii., p. 1.)

The proportion of Monocotyledons to Dicotyledons is about 1 to 2·7, and of genera to species 1 to 3·3.

Indicating the Western Peninsula and Burma with the Malay Peninsula respectively by the letters W. and E., the vast difference between the Floras of the two great regions south of the Himālaya, is made manifest by the following comparison of the number* of species contained in 27 Natural Orders common to both.

Orders in excess in the East:—

Dilleniaceæ $\frac{\text{W. 5}}{\text{E. 14}}$, *Magnoliaceæ* $\frac{\text{W. 3}}{\text{E. 8}}$, *Anonaceæ* $\frac{\text{W. 34}}{\text{E. 260}}$,
Guttiferæ $\frac{\text{W. 13}}{\text{E. 53}}$, *Ternstræmiaceæ* $\frac{\text{W. 3}}{\text{E. 24}}$, *Dipterocarpeæ* $\frac{\text{W. 12}}{\text{E. 74}}$,
Burseraceæ $\frac{\text{W. 9}}{\text{E. 33}}$, *Olacineæ* $\frac{\text{W. 19}}{\text{E. 42}}$, *Sapindaceæ* $\frac{\text{W. 40}}{\text{E. 46}}$,
Anacardiaceæ $\frac{\text{W. 24}}{\text{E. 66}}$, *Connaraceæ* $\frac{\text{W. 4}}{\text{E. 28}}$, *Myrtaceæ* $\frac{\text{W. 35}}{\text{E. 102}}$,
Melastomaceæ $\frac{\text{W. 36}}{\text{E. 123}}$, *Gesneraceæ* $\frac{\text{W. 12}}{\text{E. 70}}$, *Myristicaceæ* $\frac{\text{W. 5}}{\text{E. 47}}$,
Urticaceæ $\frac{\text{W. 74}}{\text{E. 114}}$, *Palmeæ* $\frac{\text{W. 23}}{\text{E, 128}}$, *Aroideæ* $\frac{\text{W. 40}}{\text{E, 170}}$,
Bambuseæ $\frac{\text{W. 17}}{\text{E. 30}}$, *Coniferæ* $\frac{\text{W 1}}{\text{E 9.}}$

Orders in excess in the West:—

Capparideæ $\frac{\text{W. 30}}{\text{E. 15}}$, *Umbelliferæ* $\frac{\text{W. 33}}{\text{E. 3}}$, *Commelynaceæ* $\frac{\text{W. 52}}{\text{E. 11}}$,
Acanthaceæ $\frac{\text{W. 207}}{\text{E. 34}}$, *Labiatæ* $\frac{\text{W. 127}}{\text{E. 10}}$, *Boragineæ* $\frac{\text{W. 161}}{\text{E. 8}}$,
Gramineæ $\frac{\text{W. 377}}{\text{E. 98}}$.

Furthermore, the estuarial Palms *Nipa* and *Phœnix paludosa* are unknown on the west side south of Orissa, as are *Cupuliferæ*, of which upwards of 40 species are found in the eastern region.

V. MALABAR PROVINCE. (*See* p. 7.)

Malabar is almost throughout a hilly or mountainous country and is (except in the north) of excessive humidity; the mountains rising often abruptly from the flat coast of the Arabian Sea. The average breadth of the province may be about 50 miles. Its abrupt western face is clothed with a luxuriant forest vegetation of Malayan type, except towards the north, where, with the drier climate, the elements of the Deccan and Indus-Plain Floras compete with that of Malabar. The eastern face slopes gradually into the elevated plateau of the Deccan, but it is varied by many spurs being thrown off which extend far to the eastward, often as above stated enclosing valleys with a Malabar flora. One great break occurs in the chain in Lat. 11° N., where a transverse valley separates Travancore from the mountains north of it, and carries species characteristic of the Malabar Flora almost across the Peninsula. Travancore, thus isolated, presents a remarkable similarity to Ceylon in position, outline, and in many features of its vegetation. The most distinctive characters of the Malabar Flora in contrast with that of the Deccan are primarily the presence of *Guttiferæ* (13), *Dipterocarpeæ* (12), a *Myristica*, a *Helicia*, many Palms (21), and *Bambuseæ*; secondly, the great excess of species of Malayan type, especially *Sterculiaceæ*, *Tiliaceæ*, *Anacardiaceæ*, *Meliaceæ*, *Myrtaceæ*, *Melastomaceæ*, *Ampelideæ*, *Gesneraceæ*, *Piperaceæ*, *Scitamineæ*, *Orchideæ* and *Aroideæ*. One Coniferous plant alone has been found in the whole Deccan Peninsula, *Podocarpus latifolia*, confined to the Tinnevelly Ghāts at 3 to 5,000 feet elevation. Burma and the Malayan Peninsula are the only other Provinces in which it occurs. Of the Palms, one genus is all but endemic, *Bentinckia Coddapanna*, a native of Travancore, the only congener of which is confined to the Nicobar Islands. The only species of *Pinanga* (*P. Dicksonii*) is endemic, as are nine species of *Calamus*. Other Palms are solitary species of *Arenga*, *Caryota*, *Corypha*, with the cultivated *Areca Catechu*, *Borassus*, and Coco-nut, which latter may be indigenous on the coast, as it is said to be in the Laccadive Islands. *Phœnix sylvestris*, doubtfully indigenous, is common in the north but rare in the south, and there are several indigenous species of the genus in the hills which have not been botanically distinguished. Amongst shrubs, the genus *Strobilanthes* with 46 species holds the first place, distinguished for the beauty of their flowers and for the singular habit (alluded to at p. 4) of many of their species flowering simultaneously for the first and only time at a fixed period of growth and dying after fruiting. Of *Bambuseæ* there are 17 species, arboreous and shrubby, five of them also natives of Ceylon. Amongst herbaceous plants the genus *Impatiens* with about 50 endemic species is the most conspicuous, almost carpeting the ground in many places, in others occurring epiphytically, which is not known to be the case with this huge genus in any other part of India. Of Orchids there are nearly 200. Most of the genera are epiphytic, and of these the largest is *Dendrobium*, with 16 species. *Habenaria*, with about 46 species, is the largest by far of terrestrial genera.

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* The numbers given are approximations only. The inclusion of Ceylon in the western region would only slightly modify them.

Umbelliferæ occur throughout the range, increasing in numbers northwards; 11 genera with 30 species have been recorded. Several genera of the curious aquatic Order *Podostemonaceæ*, mentioned at p. 5, abound in the fresh water torrents and in stiller waters of the Ghâts.

The Nilgiri Hills form a nœud of the Western Ghâts, where they attain their greatest elevation, viz. 8,760 feet. They rise precipitously from the west to extensive grassy downs and table lands seamed with densely-wooded gorges (Sholas). These grassy downs possess in parts a rich shrubby and herbaceous Flora. Amongst the shrubs some of the most characteristic are *Strobilanthes Kunthianus*, *Berberis aristata*, *Hypericum mysorense*, many *Leguminosæ*, as the common Gorse (introduced), *Sophora glauca* and *Crotalaria formosa*, *Rhododendron arboreum*, species of *Rubus*, *Osbeckia*, *Myrtaceæ*, *Hedyotis*, *Helichrysum*, *Gaultheria*. Amongst the herbaceous plants, are species of *Senecio*, *Anaphalis*, *Ceropegia*, *Pedicularis* and *Cyanotis*. Most conspicuous of all is the tall *Lobelia excelsa*.

But the richest assemblage is found in the Sholas which, commencing at about 5,000 feet, ascend to the summits of the range. They are filled with an evergreen forest of tall, usually round-headed trees with a rich undergrowth. Of the trees, some of the most conspicuous are *Michelia nilagirica*, *Ternstræmia japonica*, *Gordonia obtusa*, species of *Ilex*, *Meliosma*, *Microtropis*, *Euonymus*, *Photinia*, *Viburnum hebanthum*, *Eugenia* (three species), and several of *Symplocos*, *Glochidion*, *Araliaceæ*, and *Laurineæ*. Of shrubs *Strobilanthes* takes the first place, then *Rubiaceæ*, with species of *Eurya*, *Ligustrum* and *Vernonia*. Of climbers there are *Rosa Leschenaultiana*, *Jasminum brevilobum*, *Gardneria ovata*, *Gymnema hirsutum* and *Elæagnus latifolia*. The genus *Impatiens* takes the lead amongst conspicuous herbaceous plants, and the beautiful *Lilium neilgherrense* is a notable feature. At lower elevations in the Sholas, *Hydnocarpus alpina* is a very noticeable tree, and in dry localities *Rhododendron arboreum* and *Vaccinium Leschenaultii*. Two species of Bamboo are found in the Sholas, namely, *Arundinaria Wightiana* in the higher parts, and *Oxytenanthera Thwaitesii* (also a native of

Ceylon) in the lower, where also three tree-ferns appear, with many Orchids and several species of *Calamus*, all evidences of a higher temperature.

Sholas similar to those of the Nilgiris occur on the Anaimalai, Palni and other ranges of the Malabar Ghāts, but these, being of a lower elevation, and in a lower latitude, harbour a more tropical vegetation.

The most interesting feature of the Nilgiri Flora is its affinity with that of the cool regions of the far distant Khasia, Manipur and Nāga Hills in northern Burma. Amongst trees and shrubs common to these two localities (and most of them to the temperate Eastern Himālaya also), are *Ternstrœmia japonica*, *Hypericum Hookerianum* and *napaulense*, *Eurya japonica*, *Rhamnus dahuricus*, *Photinia Notoniana*, *Rubus ellipticus* and *lasiocarpus*, *Carallia integerrima*, *Rhododendron arboreum*, *Gaultheria fragrantissima* and *Gardneria ovata*, together with species of *Kadsura*, *Berberis*, *Pittosporum*, *Elæocarpus*, *Euonymus*, *Meliosma*, *Pygeum*, *Rosa*, *Viburnum*, *Lonicera*, *Vaccinium*. The herbaceous plants common to the Nilgiri and Khasia Hills are too numerous to mention. Most of them are of European genera, and some are European species, as *Stellaria uliginosa*, *Circæa alpina*, *Sanicula europæa* and *Brunella vulgaris*, Other herbaceous European genera are *Thalictrum*, *Ranunculus*, *Cardamine*, *Geranium*, *Alchemilla*, *Fragaria*, *Potentilla*, *Parnassia*, *Lysimachia*, *Swertia*, *Halenia*, *Gentiana*, *Calamintha*, *Scutellaria*, *Ajuga*, etc., with many of *Cyperaceæ* and grasses.

Peat bogs,* which are of the rarest occurrence in India, are found in depressions of the Nilgiri Hills at about 7,000 feet elevation. Their chief constituents are the debris of grasses, sedges, mosses and rushes. The curious *Hedyotis verticillata*, found elsewhere only in Ceylon, is characteristic of these bogs, whose surface is covered with a herbaceous vegetation of species of *Utricularia*, *Scrophularineæ*, *Eriocaulon*, *Xyris*, *Exacum*, *Commelynaceæ*, *Lysimachia*, etc.

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* I am indebted to Mr. Gamble, C.I.E., F.R.S., for an account of these peat bogs, which are the only ones in India of which the produce is utilised for fuel. I am also largely indebted to the same excellent botanist in respect of the Shola Flora.

The Nilgiri Hills have been largely and successfully planted with exotic trees of temperate climates, amongst which the Australian gum trees and acacias are the most conspicuous.

The *Laccadive Archipelago*,* situated in the Arabian Sea, 120 miles from the coast of Malabar, consists of coral islets fringed with Coco-nut Palms. Its vegetation is Malayan with no endemic species. The trees have mostly been introduced by man, as *Areca Catechu*, *Artocarpus integrifolia*, *Morinda citrifolia*, *Terminalia Catappa*, *Eugenia Jambos*; others, all littoral, are probably the result of ocean-borne seeds, as *Pandanus fascicularis*, *Hernandia peltata*, *Pisonia alba*, *Ochrosia borbonica*, *Guettarda speciosa*, *Thespesia populnea*. The herbaceous plants are chiefly the weeds of the Western Peninsula. The littoral grass *Spinifex* mentioned at p. 37 was probably bird- or wind-borne.

VI. THE DECCAN PROVINCE. (*See* p. 8.)

Regarding the whole Western Peninsula south of the Ganges Valley and east of the Malabar Ghāts as one botanical Province, it is primarily divisible into two Sub-provinces; one, the elevated, usually hilly, sometimes mountainous, plateau terminating eastward more or less abruptly at no great distince from the sea in what are called the Eastern Ghāts, from which the descent is more or less sudden to the low coast land of Coromandel, which forms the other Sub-province. The great plateau may prove to be further transversely divisible into Sub-provinces, but so little is accurately known of the distribution of plants over the Deccan that neither the limits nor the botanical characters of such can be satisfactorily described. Such may be—

I. The region bounded on the south by the Ajanta Hills and Godāvari river, exclusive of the plains of N.E. Orissa which belong to the Bengal Sub-province. It thus includes the upper valleys of the Nerbudda, Tāpti and Mahānadi rivers, belonging for the greater part to the political Provinces of Bombay, Central India, the Central Provinces, Western Bengal, Orissa and Berar.

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* The Botany of the Laccadives has been exhaustively explored and described by Major Prain in the *Journal of the Bombay Natural History Society*, vol. viii. (1892), where 190 species of Flowering plants are recorded.

It is hilly and even mountainous almost throughout, rising in scattered isolated peaks or table lands to above 4,000 feet, of which the two loftiest are Parasnāth in Hazāribāgh elevated 4,490 feet and Mahendragiri 4,500 feet in Ganjam near the sea.

The Flora, though mainly that of other parts of the Deccan, presents besides a few types of the Eastern and Western Himālaya, both tropical and temperate, as epiphytic Orchids, species of *Thalictrum* and *Berberis*; and what is more singular, a few plants elsewhere confined to the humid districts of Assam and Burma,* as *Dysoxylum procerum*, *Pygeum acuminatum*, *Lasianthus laurifolius*, *Dysophylla Andersoni*, *Ardisia depressa*, *Beilschmiedia fagifolia*, and *Cyclostemon assamicus*.

II. The Deccan, in a restricted sense, the country between the Godāvari and Kistna rivers, a much less mountainous region including Hydarabad.

III. Mysore, roughly limited by the Kistna river on the north, and the lower course of the Cauvery on the south. It is more hilly than the Deccan proper and even mountainous in the Salem district, where the botanically unexplored Shevaroy and Kalrayan Hills are said to attain 5,000 feet elevation.

IV. The small districts of Madura and Tennevelly, which form a prolongation of the Coromandel coast terminating at Cape Comorin.

Over the Deccan Province deciduous forests are the most conspicuous feature on the plateau, and comparatively evergreen ones on the coasts and slopes with an eastern aspect. The Teak occurs at intervals over the whole area, but the Sal, which is common in the north, does not advance beyond the Godāvari on the south or west of long. 78° E. Much of the open country presents a jungle of small trees and shrubs, together with a herbaceous vegetation which is leafless or burnt up in the dry season. In the large river valleys and those of the higher hills, types of the Malabar Flora penetrate far to the east. Of forest trees there are several hundred species, amongst which *Sterculiaceæ*, *Meliaceæ*, *Leguminosæ*, *Combretaceæ*, *Bignoniaceæ* and *Urticaceæ* are well represented. The Satin wood (*Chikrassia tabularis*), Indian Red-wood (*Soymida febrifuga*) yield the most ornamental Indian timbers; the Toon (*Cedrela Toona*) one of the most useful. The odoriferous Sandal wood (*Santalum album*) is widely distributed over the area, as are the small trees *Cochlospermum Gossypium*, *Butea frondosa*, and some species of *Bauhinia*, all conspicuous in the dry season for their beautiful flowers. Of shrubs, species of *Capparis*, *Grewia*, *Flacourtia*, *Zizyphus*, *Diospyros*, *Flueggia*, and *Phyllanthus* are very prevalent, often overgrown with climbing *Menispermaceæ*, *Malpighiaceæ*, *Toddalia*, *Cuscuta*, *Cassytha*, *Smilax*, *Dioscorea*, *Asclepiadeæ*, *Apocyneæ*, *Ampelideæ*, and *Convolvulaceæ*. In rocky places the columnar *Euphorbia neriifolia* and *tortilis* are conspicuous features. The herbaceous vegetation of the Deccan includes most of the common annuals and perennials of Bengal, amongst which *Acanthaceæ* are notable. *Commelynaceæ* and species of the Labiate genus *Leucas* are more abundant than in any other Indian Province. Except in the northern districts *Orchideæ* and *Scitamineæ* are very rare. Of Palms there are *Calamus viminalis*, *Phœnix sylvestris* and *Borassus flabellifer*, the two latter growing gregariously; and there are besides *P. acaulis* and *P. humilis* all in the northern district, and an undetermined species grows gregariously in the Shevaroy Hills near Salem. The chief Bamboos are *Bambusa arundinacea* and *Dendrocalamus strictus*. Ferns and their allies are very rare, except in the north, where 47 species are recorded from Chota Nagpur.

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* For a list of which recent discoveries, I am indebted to Major Prain, F.L.S., of the Royal Botanic Gardens, Calcutta.

The rich black cotton soil that prevails over large areas in the Deccan deserves a special notice, as being characterized by a peculiar assemblage of the indigenous plants of the Province. I am indebted to Mr. Gamble for the following list of its common trees, *Capparis divaricata*, *Acacia arabica*, *Prosopis spicigera*, *Parkinsonia aculeata* and *Balanites Roxburghii*; of shrubs, *Cadaba indica*, *Zizyphus nummularia*, *Cassia auriculata*, *Calotropis procera* and *Jatropha glandulifera*; and of herbs *Hibiscus Trionum*, *Momordica cymbalaria*, and *Cressa cretica*.

Coromandel Sub-province.—The narrow strip of low-lying land between the Eastern Ghâts of the Deccan and the sea is dry, hot, and, in many districts, sandy. Except at the mouths of the many rivers where Mangroves and other common estuarial trees and shrubs prevail, there is little to break the uniformity of the vegetation, which is of the Deccan type with a greatly reduced number of species. Thickets of thorny evergreens and deciduous trees and shrubs abound, belonging to the genera *Flacourtio*, *Randia*, *Scutia*, *Diospyros*, *Mimusops*, *Garcinia*, *Sapindus*, *Pterospermum*, etc. It is well known for being a favoured district for the production of Nux vomica, Satin wood, and Ebony (*Diospyros Ebenum*).* Two very peculiar gregarious plants, a palm and a grass, form impenetrable spinous thickets in sandy soils near the sea; these are *Phœnix farinifera* and *Spinifex squarrosus*, of which latter great globular masses become uprooted and carried with the wind along the shore.

In the extreme south the districts of Madura and Tinnevelly, being sheltered from the monsoon by the Palni mountains on the N. and Ceylon on the E., are exceptionally hot and arid. The umbrella-shaped *Acacia planifrons* is confined to these districts and to north Ceylon, regions which resemble Egypt in the prevalence of *Cocculus Leæba*, *Capparis aphylla*, and in the production of the finest Cotton, and of the best Indian Sennas (*Cassia obovata* and *angustifolia*).

VII.—THE CEYLON PROVINCE. (*See* p. 8.)

Ceylon, though so near in position to the Western Peninsula, and presenting so close an affinity to its Florà as also to those of both Malabar and the Deccan, nevertheless contains so large a proportion of endemic genera and species that it constitutes a separate Province of the Indian Flora. Its botanical features coincide with its physical, the moist mountainous southern and south-western districts having a Flora of the Malabar type, and the hot dry northern districts one of the Coromandel type. It differs from the Malabar Flora in having many more Malayan types.

The number of indigenous Flowering plants in Ceylon is about 2,800, under 149 Natural Orders, and that of Ferns and their allies 257 species. Of these 2,800 species no fewer than one third (940) are non-Peninsular, of which again 160 are natives of other parts of India, the majority of them being Burmese or Malayan, leaving 780 endemic Ceylon species. The following are the 10 dominant Orders of Ceylon Flowering plants, with their corresponding position in the Peninsular decad added in brackets :—

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* *D. Ebenum* is also a native of Ceylon, but the Sandal wood is not.

1. *Gramineæ* (1).
2. *Leguminosæ* (2).
3. *Orchideæ* (4).
4. *Cyperaceæ* (5).
5. *Rubiaceæ* (7).
6. *Euphorbiaceæ* (6).
7. *Acanthaceæ* (3).
8. *Compositæ* (8).
9. *Urticaceæ*.
10. *Melastomaceæ*.

The proportion of Monocotyledons to Dicotyledons is nearly 1 to 3·6, and of genera to species about 1 to 2·6. Comparing the above decad with the W. Peninsular (p. 29) it is seen that *Orchideæ* and *Rubiaceæ* are more numerous in Ceylon, *Acanthaceæ* much fewer; and that *Urticaceæ* and *Melastomaceæ* replace *Labiatæ* and *Asclepiadeæ*. These changes all point to the stronger Malayan affinity of the Ceylon Flora, which is further demonstrated by the following figures, where the letter C. indicates Ceylon, and P. the Western Peninsula :—

Malayan affinity strongest in Ceylon—

Dilleniaceæ $\frac{\text{C. 15}}{\text{P. 5}}$, *Guttiferæ* $\frac{\text{C. 19}}{\text{P. 13}}$, *Ternstræmiaceæ* $\frac{\text{C. 7}}{\text{P. 8}}$,
Dipterocarpeæ $\frac{\text{C. 46}}{\text{P. 12}}$, *Sapindaceæ* $\frac{\text{C. 19}}{\text{P. 14}}$, *Myrtaceæ* $\frac{\text{C. 49}}{\text{P. 35}}$,
Melastomaceæ $\frac{\text{C. 52}}{\text{P. 36}}$,

Western Peninsular affinity strongest in Ceylon—

Cappārideæ $\frac{\text{C. 20}}{\text{P. 31}}$, *Tiliaceæ* $\frac{\text{C. 30}}{\text{P. 49}}$, *Meliaceæ* $\frac{\text{C. 14}}{\text{P. 25}}$,
Ampelideæ $\frac{\text{C. 20}}{\text{P. 36}}$, *Umbelliferæ* $\frac{\text{C. 10}}{\text{P. 33}}$, *Oleaceæ* $\frac{\text{C. 12}}{\text{P. 31}}$,
Asclepiadeæ $\frac{\text{C. 39}}{\text{P. 96}}$, *Boragineæ* $\frac{\text{C. 18}}{\text{P. 37}}$, *Acanthaceæ* $\frac{\text{C. 93}}{\text{P. 207}}$,
Labiatæ $\frac{\text{C. 42}}{\text{P. 127}}$, *Liliaceæ* $\frac{\text{C. 18}}{\text{P. 39}}$, *Commelynaceæ* $\frac{\text{C. 30}}{\text{P. 52}}$.

Four Ceylon Orders are absent in the Western Peninsula, *Cactaceæ*, *Stylidieæ*, *Nepenthaceæ*, and *Monimiaceæ ;* and four Peninsular Orders are absent in Ceylon, *Moringeæ*, *Salicineæ*, *Gnetaceæ*, and *Coniferæ*. Of the above, *Cactaceæ* is the most noteworthy, being represented by the only species of that vast New World Order which is known to be indigenous in the Old World, namely, *Rhipsalis Cassytha*, also a native of tropical America, Africa, the Mauritius and Madagascar. The absence in Ceylon of *Coniferæ* and especially of *Salicineæ* is remarkable, *Salix tetrasperma* being a very widely spread Indian shrub or small tree.

Ceylon possesses no fewer than 23 endemic genera, of which 10, comprising 46 species (all but two endemic), belong to the typical Malayan Order of *Dipterocarpeæ*, which is represented by only 12 species in the Peninsula. The principal Orders containing very many endemic species are *Orchideæ* 74, *Rubiaceæ* 72, *Euphorbiaceæ* 53, *Melastomaceæ* 38, and *Myrtaceæ* 26; and of genera *Strobilanthes*, *Eugenia*, *Memecylon*, *Phyllanthus*, and *Hedyotis*. The genus *Impatiens* abounds; upwards of 21 species are recorded, nearly all of them endemic. Of other conspicuous Orders, *Orchideæ* contains 160 species, more than half of them endemic. Of Palms, eight genera are endemic, and there are 18 endemic species, exclusive of the introduced Betel-nut, *Borassus* and Coco-nut. The Talipot (*Corypha umbraculifera*) is one of the most imposing of the Order. The *Nipa* occurs rarely, Ceylon being its western limit, Australia its eastern. *Cycas circinalis* is common in the forests. Of *Bambuseæ* there are five genera and 10 species (of which four are endemic). At elevations above 6,000 feet a few temperate northern genera appear, fewer than might have been expected in mountains that attain heights of upwards of 7,000 and 8,000 feet. Of these genera, *Agrimonia*, *Crawfurdia*, and *Poterium* are not Peninsular. The following are also Peninsular: *Anemone*, *Thalictrum*, *Berberis*, *Cardamine*, *Viola*, *Cerastium*, *Geranium*, *Rubus*, *Potentilla*, *Alchemilla*, *Sanicula*, *Pimpinella*, *Peucedanum*, *Galium*, *Valeriana*, *Dipsacus*, *Artemisia*, *Vaccinium*, *Gualtheria*, *Rhododendron*, *Gentiana*, *Swertia*, *Calamintha*, *Teucrium*, *Allium*. Of Peninsular temperate genera that are absent in Ceylon, *Fragaria* and *Rosa* are two the occurrence of which might have been expected, both being Nilgiri genera.

Remarkable features in the vegetation of Ceylon are the *Patanas*, grass- or shrub-covered stretches of country, most prevalent in the south-east of the island, from the sea to 5,000 feet altitude. They are partly natural and partly due to the destruction of the forests. A peculiar, endemic, pale green Bamboo covers hundreds of square miles of these Patanas, *Ochlandra stridula*, so called from the crackling noise caused by treading on the broken stems. In grassy places *Imperata arundinacea* prevails; and in scrubforests such tropical trees occur as *Pterocarpus Marsupium*, *Careya arborea*, *Phyllanthus Emblica*, *Terminalia Belerica* and *T. Chebula*. At higher levels *Rhododendron arboreum* appears. In moist districts a fern (*Gleichenia linearis*) occupies the ground.*

The Maldive Archipelago, a very large group of Coral Islets with few other flowering plants than Coco-nut Palms, littoral shrubs, and weeds of cultivation, lies about 400 miles S.W. of Ceylon, to which the group is subordinate. A list of 115 species, exclusive of *Cyperaceæ* and *Gramineæ*, is given by Mr. F. Lewis, F.L.S., who has published an exhaustive study of their Botany in the *Indian Forester*, vol. xxviii (1902) p. 211.

VIII.—THE BURMESE PROVINCE. (*See* p. 8.)

Burma is botanically by far the richest Province of British India, and at the same time, as such, the least known. This is due to its great area; to its variety of climates, from a littoral and southern of great humidity to a drier interior, almost arid in places; to its complicated systems of mountain ranges; and to its many geological features and surface soils. The greater part of Burma having been only comparatively recently brought under British rule, very large areas of it are as yet in great part botanically unvisited. This is especially the case with the meridional ranges of Chittagong and Arakan, which extend for 500 miles along the Bay of Bengal attaining an elevation in parts of 6,000 to 8,000 feet; and with the many continuous or broken often multiple ranges bounding Burma on the east from Assam to the Keda district of the Malay Peninsula, which extend for 1,500 miles, and reach even greater elevations. There are also subsidiary longitudinal ranges betweeen the great rivers that have never been botanized, and arid interior areas with little or no rainfall.

The Burmese Province when better known will probably prove to be botanically divisible into four Sub-provinces, before discussing which some general observations on the cardinal features of its whole Flora are necessary. Its recorded species of Flowering plants amount to about 6,000[*] under 161 Natural Orders, of which the following ten are the dominant, the numbers following in brackets showing their corresponding positions in the tropical zone of the Eastern Himālayan Province on the north (p. 12.)

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* For an excellent detailed account of the Patanas vegetation, see H. H. W. Pearson, F.L.S., in *Journal Linnean Society*, Bot. xxxiv (1899) 300 and xxxvi (1903) 430.

1. *Orchideæ* (1).
2. *Leguminosæ* (2).
3. *Gramineæ* (3).
4. *Rubiaceæ* (7).
5. *Euphorbiaceæ* (5).
6. *Acanthaceæ* (10)
7. *Cyperaceæ* (6).
8. *Urticaceæ* (4).
9. *Compositæ* (8).
10. *Scitamineæ*.

The proportion of Monocotyledons to Dicotyledons is about 1 to 2·3; of genera to species 1 to 3·25. One Order alone (*Scitamineæ*) is not in the Sikkim decad. *Acanthaceæ* are relatively much more numerous in Burma, *Urticaceæ* in Sikkim; but these proportions are founded on very insufficient data. Over and above the Orders included in the decad the following are very largely represented in Burma:—

Magnoliaceæ (21 sp.), *Dipterocarpeæ* (26 sp.), *Begoniaceæ* (43 sp.), *Melastomaceæ* (57 sp.), *Gesneraceæ* (60 sp.), *Asclepiadeæ* (100 sp.), *Cupuliferæ* (44 sp.), *Laurineæ* (100 sp.) *Myristiceæ* (11 sp.), *Coniferæ* (8 sp.), *Cycadeæ* (3 sp.), *Palmeæ* (68 sp.), *Pandaneæ* (12 sp.), *Bambuseæ* (68 sp.). Balsams and Ferns abound, but data are wanting for even a rude estimate of their numbers; about 40 Balsams have been collected. The Coniferous genera are *Cephalotaxus, Taxus, Dacrydium, Podocarpus* (2 sp.) and *Pinus* (2 sp.). Of *Orchideæ*, 700 species are recorded. Burma being in the main a forest-clad country, it may be well as an initial step, in sketching what is known of its Flora, to regard it as a whole under this point of view. Fortunately Kurz in his *Forest Flora of British Burma*[†] has classified the forests as known to him with remarkable lucidity. I shall therefore, before proceeding to indicate botanical sub-divisions of the Province, summarize his chief results, premising that the northern districts which are politically in Assam, and which I regard as a Sub-province of Burma, are not included in his work.

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[*] In the revised and enlarged edition of "Mason's Burma" by W. Theobald (1883) 3,545 species of Flowering plants and 215 of Ferns and their allies are recorded, and the proportion of Monocotyledons to Dicotyledons is 1 to 3·4. The first of these classes has evidently been neglected by collectors, as is shown by *Gramineæ* ranking only 8 and *Cyperaceæ* 10 in the decad of largest Orders. Mason's Burma is of course the old Political Province of that name, which does not include the northern districts here included in botanical Burma.

[†] In this work Kurz has given under each class of forests a multitude of examples of their constituent plants.

The forests are classified by Kurz according as they are evergreen or deciduous, in relation to their elevation above and proximity to or distance from the sea, their climatic and geological conditions, and the nature of the soil* in which they grow; to which are added observations on their associated plants, shrubby and herbaceous.

1. Evergreen littoral forests. These are estuarial, and of the same character and with the same conditions as the Sundarbans of Bengal. They appear at intervals along the coast.

2. Evergreen swamp forests occupy the low land and depressions in alluvial plains, and borders of lakes and rivers. They shelter a multitude of trees, shrubs and herbaceous plants, the most characteristic trees being *Mangifera longipes* and *Xanthophyllum glaucum*.

3. Evergreen tropical forests are the most strongly Malayan; they affect the humid coast districts and are the special home of Dipterocarps, Palms, and Bamboos. They prevail along the coast range from Chittagong to Tenasserim.

4. Evergreen Hill forests succeed the tropical above 3,000 feet elevation. Oaks and their allies are characteristic, and, if the climate is sufficiently damp, epiphytic Orchids appear. Above 6,000 feet this forest becomes stunted and in it Rhododendrons (including *R. arboreum*) *Eurya*, *Rosa*, Honeysuckle, dwarf Bamboos and other temperate shrubs appear, with *Anemone*, *Viola*, *Gentiana*, the common Bracken, Mosses and Lichens. The crests of the ridges are often crowned with clumps of *Pinus Khasya* towards the north and *P. Merkusii* towards the south.

5. Open deciduous forests affect diluvial or older alluvial soils; the Eng (*Dipterocarpus turbinatus*), whence the name of Eng forest, is the characteristic tree, and there are other species of the same Order, together with a few Oaks, Palms and Bamboos.

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* The soils are laterite, or are derived from sandstone or calcareous rocks, or saline, or swampy.

6. Dry deciduous forests recall the vegetation of the Deccan; *Acacia Catechu* is characteristic, and gives its name (Cutch) to a special class of forests in which it is the most valuable tree. The soil is usually calcareous.

7. Mixed deciduous forests are of two classes, an upper and a lower. The upper are restricted to sandstone or metamorphic soils; Teak is the characteristic tree, Palms and Dipterocarps are few, Deccan types are numerous. The lower deciduous forests occupy alluvial soils, and have, consequently, a different undergrowth.

8. Dune forests are deciduous and mixed; they are littoral, occupying calcareous sands and gravels. Species of *Erythrina*, *Bombax*, *Afzelia*, and some estuarial plants occur in them, with *Cycas Rumphii* and *Pandanus fascicularis*. *Ipomœa biloba* and creeping grasses cover the sands.

9. Bamboo jungles are formed of many species of *Bambuseæ*, often presenting impenetrable thickets and strangling other plants. Seldom more than two species are associated together.

10. Savannahs are limited tracts of what would be swamp forests had they more trees in them. They are covered with tall coarse grasses, as *Saccharum spontaneum*, *Arundo madagascariensis*,* *Phragmites Karka*, *Polytoca barbata*, many sedges, and in drier places *Imperata arundinacea*.

Assuming Burma as a botanical Sub-province to be divisible into four, a Northern, Western, Eastern and Central may be outlined as follows:—

Northern Burma †.—A mountainous country extending for 500 miles in a N.E. direction from the great bend of the Brāhmaputra in Bengal to the Chinese portion of Yunnan. Its northern boundary is the range of mountains flanking the Assam valley on the south. Politically it belongs to Assam, and its chief districts, beginning at the west are known as the Gāro, Khāsi, Nôwgong, Jaintia, Nāga, Patkai and Manipur Hills, the direction of all which is from S.W. to N.E., except in Manipur where they trend from N. to S. The average height of these hills may be 4,000 to 5,000 feet, with a few peaks rising to above 10,000. The climate is of maximum humidity; there are no arid areas as in Central Burma. The vegetation throughout this Sub-province approximates to that of the Eastern Himālaya, differing conspicuously in the absence of an Alpine zone, and of any species of *Picea*, *Abies*, *Tsuga*, *Larix* or *Juniperus*, and in the presence of *Pinus Khasya* and of a Pitcher plant (*Nepenthes*). From that of Central and Southern Burma it differs in the absence of Teak, in the paucity of Dipterocarps, in the presence of Sāl which, in the Gāro Hills, finds its eastern limit, and of *Pinus Khasya*, which is replaced further south by *P. Merkusii*. In the valleys and lower elevations the vegetation of the tropical zone of the Himālaya prevails, but at elevations above 4,000 feet temperate genera and species mainly replace them, many of them identical with the Himālayan, though maintaining a lower level by 3,000 feet or more. Such are, of herbaceous plants, species of *Ranunculus*, *Anemone*, *Thalictrum*, *Delphinium*, *Corydalis*, *Geranium*, *Impatiens*, *Drosera*, *Astragalus*, *Rubus*, *Potentilla*, *Fragaria*, *Sanguisorba*, *Astilbe*, *Parnassia*, *Valeriana*, *Senecio*, *Pedicularis*, *Primula*, *Tofieldia*, *Iris*, *Allium*, *Paris*, and many others. Of temperate shrubs, there are species of *Berberis*, *Cleyera*, *Camellia*, *Eurya*, *Saurauja*, *Ilex*, *Neillia*, *Luculia*, *Viburnum*, *Ligustrum*, *Rhododendron*, *Vaccinium*, *Gaultheria*, and many others of Himālayan type. Of trees at the high level, amongst the most conspicuous are *Rhododendron arboreum*, species of *Magnolia*, *Manglietia*, and *Michelia*, *Acer*, *Prunus*, *Pyrus*, *Pieris*, *Bucklandia*, *Alnus*, *Betula*, *Carpinus*, *Quercus* (20 sp.), *Taxus*, and *Pinus Khasya*.

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* *Neyraudia madagascariensis*, of *Fl. Brit. Ind.*, vii., 305, which Dr. Stāpf has recently proved to be a species of the African and Australian genus *Triraphis*.

† This botanical Sub-region is recognized by Major Prain (see *Botanical Survey of India*, vol. i. p. 284) who refers to it the Lushai Hills, Tippera, Chittagong, Arakan, and the Andaman Islands.

A conspicuous feature of the western district of this Sub-province is the open unforested character of elevations above 4,000 feet, reminiscent of the Nilgiri Hills and presenting genera of trees, shrubs and herbs common to those far distant regions (see p. 33). It is in one spot of a few yards wide alone in all Burma * (in the Jaintia Hills) that the pitcher-plant (*Nepenthes khasiana*) is found growing prostrate amongst wet grass and stones, at an elevation of about 4,000 feet. It is the northernmost known member of this singular genus, its British Indian congeners being natives of Ceylon and the Malayan Peninsula, the latter 1,500 miles to the southward, and they are all climbers. It has not been found elsewhere.

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* In Mason's *Burma* (vol. ii. p. 230) a *Nepenthes* is reported to have been found in Mergui by the Rev. C. Parish, but its discovery has never been confirmed.

To the eastward the loftier regions of this Sub-province are forest-clad, Bamboos often replacing the arboreous vegetation and dominating the scenery. It is a singular fact that Manipur, the most distant of the districts from Sikkim, possesses species of the latter country not hitherto found elsewhere in Burma.

Western and Southern Burma.—The botany of this humid strip of land between the sea and the crests of the Chittagong and Arakan Hills differs from that of Central Burma, being interrupted by the estuarial Flora of the deltas of the Irrawaddy, Sitaung and other rivers, eastward of which it reappears along the Tenasserim coast to Mergui. Though many collections have been made in different parts of it,* these do not suffice to supply a decad of its dominant Natural Orders. The nature of its tree vegetation may be gathered from Kurz's classification given above, which is that of a dense evergreen forest where Dipterocarps (26 sp.), Oaks and Bamboos are conspicuous features, some of the first of these towering over all other trees. Ferns, scandent Palms and Orchids abound, of which latter Order novelties are still being sent to botanical establishments in India and Europe. The general character of the vegetation may be gathered from Nos. 3 and 4 of Kurz's classification of the Burmese forests (p. 42). In detail it may be supposed to contain many plants of the temperate regions of the North Burmese Sub-province.

Eastern Burma.—The Flora of the complicated ranges of mountains intervening between Burma and China on the north and Siam in the south is all but unknown. They have been visited by few botanists or collectors, and their very limited collections throw little light on the interesting question of the community or diversity of the border Floras of these three countries. Only four such collections are known to me; Lieutenant Pottinger's in the Kachin Hills, Sir H. Collett's in the Shan States, and those of the Reverend C. Parish and of Thomas Lobb in the Tenasserim Mountains.

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* Especially in Pegu and Tenasserim. In the latter country Griffith, in 1832, commenced his Indian career as an explorer of botanically unknown regions, which occupied 13 years of his life without a break, and extended from Afghānistān to the Chinese frontier in Assam, and from Bhutan to the Malay Peninsula. Large collections in the Mergui Province and Archipelago were subsequently made by Mr. Helfer.

Lieutenant Pottinger's collections were made in 1897 at elevations of 450 to 7,000 feet in a mountainous country in the extreme north-east of Central Burma, between lat. 25° and 27° N., and long. 97° and 99° E.; that is a little to the eastward of the Hukum valley by which Griffith entered Central Burma in 1836. They were made under great difficulties, owing to the climate and to the hostility of the natives, so that a large proportion of them were lost. In Major Prain's account* of this collection he records 601 Flowering plants and 27 Ferns and their allies, of the former of which 41 are endemic new species, including a new genus of *Leguminosæ* (*Cruddasia insignis*), and another allied to *Escallonia*. Not a single Oak is on the list, which is very remarkable (the specimens were presumably lost). Teak here finds its northern limit in Burma (the trees of it were gnarled); as does *Shorea siamensis*, the only Dipterocarp on the list. The Tea plant was found throughout the route. Only four species of *Impatiens* were collected, but many were seen. Of the few plants hitherto supposed to be endemic in China, but now found also in Burma, the most conspicuous were *Wistaria chinensis*, *Rhododendron indicum*, and *Gelsemium elegans*, which latter is not included in the Flora of British India, although it had been found in Assam. The following are the 10 dominant Orders, with their approximate number of species in each :—

1. *Orchideæ*, 77.
2. *Leguminosæ*, 60.
3. *Acanthaceæ*, 26.
4. *Rubiaceæ*, 25.
5. *Labiatæ*, 20.
6. *Urticaceæ* 20.
7. *Euphorbiaceæ*, 18.
8. *Compositæ*, 17.
9. *Scitamineæ*, 17.
10. *Aroideæ*, 17.

The contrast between the Kachin collection and that made by Sir H. Collett only some 200 miles to the southward in about the same longitude, and for the most part at similar elevations, is startling, and can only be accounted for by assuming that in both cases the number of species collected was too small for an instructive comparison. Of Pottinger's 601 Flowering plants not 100 are recorded among Collett's 843.

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* *Records of the Botanical Survey of India*, vol. i. (1898), p. 215, with two maps. It contains a most instructive article " On the Nature and Affinities of the Kachin Flora."

Sir H. Collett's collections were made in 1887–88 in Upper Burma and the Southern Shan States; that is in the valleys of the Salween and Sitaung rivers, lat. 19½°–21½ N., long. 96°–97½° E.; and on Popah, a mountain 5,000 feet high, in the Irrawaddy valley. They contain 843 species of Flowering plants which have been enumerated by himself and Mr. Hemsley in the *Journal of the Linnean Society*,* where no fewer than 83 are described as new and endemic. The most remarkable of the novelties were *Osteomeles anthyllidifolia*, a Rosaceous shrub resembling the Blackthorn, previously known as a native of China and of some Pacific Islands, all whose congeners are Andean; a Rose and a Honey-suckle (*Rosa gigantea* and *Lonicera Hildebrandiana*), both with flowers of extraordinary size, and a new genus of *Leguminosæ* (*Neocollettia*). The collection contained nine Oaks.

Though so near the Chinese frontier, few species of that country were added to the Burmese Flora; the most interesting was a species of *Speranskia*, a monotypic Chinese Euphorbiaceous genus. About 25 of the species and one-fifth of the genera are British.

The following are the 10 dominant Orders in Sir H. Collett's collection, with the approximate number of species in each:—

1. *Leguminosæ*, 90.
2. *Gramineæ*, 80.
3. *Compositæ*, 60.
4. *Labiatæ*, 41.
5. *Rubiaceæ*, 30.
6. *Acanthaceæ*, 30.
7. *Convolvulaceæ*, 29.
8. *Euphorbiaceæ*, 25.
9. *Orchideæ*, 22.
10. *Verbenaceæ*, 21.

The collection, having been made at various elevations between 3,000 and 12,000 feet, is one of mixed tropical and temperate types, the latter descending as low as 4,000 feet, according to Sir H. Collett's observation. The most salient features of the collection are the fewness of *Orchideæ* and the large number of *Compositæ*; but very many Orchids have since been found in the same collecting ground, chiefly around Fort Stedman and the Tale

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* Botany, vol. xxviii (1890), with a full account from Sir H. Collett's pen of the vegetation of the tracts he visited.

Lake. *Tectona Hamiltoniana* is included, but not the true Teak (*T. grandis*).

The Reverend C. Parish's collection, and that of Thomas Lobb, a collector for Messrs. Veitch, are chiefly Orchids, of which many interesting species were discovered in Mulyet and Mokai mountains, altitude 5,000 and 6,300 feet, in Tenasserim. The existence of a *Nepenthes* in Mergui is alluded to on p. 44 (footnote). A more remarkable discovery, if confirmed, is that of a *Rafflesia* in the pass of Ta-ok, east of Moulmein, at an elevation of 3,000 feet, recorded by Mr. Theobald in Mason's *Burma*, ii., 828.

Central Burma, between the Arakan ranges and those east of the Sitaung river, is divisible into two regions, a northern dry, and a southern humid, but in what latitude the change of climate becomes marked by the vegetation is not determined; it is, no doubt, irregular in its course, and influenced by the great rivers, by the hills between these, and by proximity to the Arakan range which exhausts the moisture of the south-west monsoon. One small district, that of Minbu, between the Irrawaddy and Arakan, in lat. 20° N., is spoken of as being a desert, no doubt figuratively.* The character of the Upper Central vegetation is largely, if not typically, that of the Deccan Province; it agrees with that of No. 6 in Kurz's classification (p. 43), in being mainly dry deciduous. Two species of Teak (*Tectona grandis* and *T. Hamiltoniana*) occur, with many Leguminous trees, *Acacia Catechu* often forming forests, and more rarely *Dipterocarpus turbinatus*.

The Andaman Islands have been visited by botanists at few and distant points only, of which the chief is Port Blair. Kurz collected in them 560 species of flowering plants†; and Major Prain, who visited several of the smaller Islets, Barren Island, Narcondam, and the Coco as well as one of the main Islands, added perhaps 150 to Kurz's record. The total would probably not exceed one-third of the whole Flora. The forests with which most of the Archipelago is clad are typically Burmese and are regarded by Kurz as a less developed stage of his seventh class, mixed evergreen and deciduous. Their most remarkable feature is the apparently total absence of the Cupuliferous genera *Quercus* and *Castanopsis*, of the first of which there are 40 species on the neighbouring continent, and of the second 11. Of *Dipterocarpeæ* there are very few, of *Myristica* 4. Considering however, that nothing is known of the vegetation over nearly the whole of the Archipelago and that its interior hills which reach 2,400 feet in altitude have not been botanized over, it is evident that it would be premature to regard the apparent absence of *Cupuliferæ* as an ascertained fact, or indeed that of any of such other desiderata as Mr. Kurz indicates, namely *Magnoliaceæ, Onagraceæ, Umbelliferæ, Vacciniaceæ, Sorophularinese, Labiatæ, Polygoneæ, Amarantaceæ, Salsolaceæ, Coniferæ, Pontederiaceæ, Hypoxideæ*, and other small families, and all fresh-water plants. One Coniferous plant (*Podocarpus*) is included in his Forest Flora as a native of the Andamans, and others of the desiderata have, since the publication of that work, been found by Major Prain.

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* Quite recently this especially arid district has been botanized by Capt. Gage of the Calcutta Botanical Garden, under the direction of Major Prain, who will doubtless soon publish the result. Its Flora is expected to prove almost purely Deccan.

† See for details his Report to the Indian Government on the vegetation of the Andamans, where the species are all enumerated and discussed. *Memoirs and Memoranda* by D. Prain, Calcutta, 1894.

The Nicobar Islands are even less known botanically than the Andamans, and it is questionable whether they belong to the Burmese or to the Malay Peninsular Flora. They were visited both by Mr. Kurz,[*] who collected on Katchall and Kamorta 573 Flowering plants and 50 Ferns and their allies, and by Major Prain, who obtained 110[†] on the islets of Car Nicobar, Batti Malv and a few other localities, adding considerably to his predecessor's list. The general character of their vegetation is that of the Andamans, with the apparent absence of *Dipterocarpeæ, Datiscaceæ*, and the *Podocarpus*. The presence in the Nicobars of a genus of *Monimiaceæ*, an Order elsewhere in British India confined to the Malayan Peninsula and Ceylon, would indicate a closer affinity with these Provinces. On the other hand the occurrence of *Capparis ambigua*, a plant confined to the two Archipelagos, indicates a community in their

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[*] See *Journal of the Asiatic Society of Bengal* (1876), p. 105.

[†] Enumerated and fully discussed in his *Memoirs and Memoranda*.

Floras. It would be interesting to know whether any species of *Nepenthesæ*, of which 8 are found in the Malay Peninsula, exist in the Nicobars.

IX. THE MALAYAN PENINSULA PROVINCE. (*See* p. 8).

Except the Island of Penang, and the Protected States of Perak, Selangor, and the British territories of Wellesley, Malacca and Singapore, little is known of the Flora of this Peninsula, the greater part of which is under the Siamese dominion. Of the range of mountains which forms its backbone and which rises to peaks 4,000 to 7,000 feet in height, two only have been visited botanically, namely one, alt. 7,000 feet, in Perak, and Mt. Ophir, alt. 4,183 feet, in Malacca. It is hence obvious that materials do not exist for estimating with any approach to finality either the Flora as a whole or the relative number of its dominant Natural Orders.

Except when cultivation interferes, the whole Peninsula is clothed with an evergreen vegetation, that of the shore being estuarial. Mr. Ridley informs me that the number of species of the Peninsular Flowering plants in the rich herbarium of the Royal Gardens at Singapore is 4,547, and of Ferns and their allies 368; but this does not include many species discovered by collectors sent from the Royal Gardens, Calcutta, which are in course of publication* by Sir George King. The 10 dominant Orders are, as given me by Mr. Ridley, the following, to which I have added in brackets their corresponding position in the Burmese decad :—

1. *Orchideæ* (1).
2. *Leguminosæ* (2).
3. *Euphorbiaceæ* (5).
4. *Rubiaceæ* (4).
5. *Anonaceæ*.
6. *Gramineæ* (3).
7. *Scitamineæ* (10).
8. *Melastomaceæ*.
9. *Cyperaceæ*.
10. *Urticaceæ* (8).

The proportion of Monocotyledons to Dicotyledons is 1 to 2·2, and of genera to species 1 to 2·3. The numbers attached to the

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* In the *Journal* of the Bengal Branch of the Royal Asiatic Society, where descriptions are or will be given of all the known flowering plants of the Malay Peninsula. The large Orders not yet worked up for that work, which may interfere with the sequence of the above decad, are *Euphorbiaceæ*, *Laurineæ*, and *Urticaceæ*.

Orders in this decad afford striking evidence of the difference between the Floras of Burma and the Malay Peninsula, which may be even more forcibly illustrated by the following contrasts, where the letters M. and B. represent the two Provinces:—

Orders with a great preponderance in the Malayan Peninsula—

Dilleniaceæ $\frac{\text{M. 18}}{\text{B. 8}}$, *Bixineæ* $\frac{\text{M. 24}}{\text{B. 11}}$, *Guttiferæ* $\frac{\text{M. 66}}{\text{B. 20}}$,
Dipterocarpeæ $\frac{\text{M. 73}}{\text{B. 26}}$, *Polygaleæ* $\frac{\text{M. 32}}{\text{B. 16}}$, *Meliaceæ* $\frac{\text{M. 90}}{\text{B. 39}}$,
Anacardiaceæ $\frac{\text{M. 67}}{\text{B. 35}}$, *Connaraceæ* $\frac{\text{M. 33}}{\text{B. 15}}$, *Myrtaceæ* $\frac{\text{M. 123}}{\text{B. 66}}$,
Melastomaceæ $\frac{\text{M. 136}}{\text{B. 53}}$, *Myristicaceæ* $\frac{\text{M. 47}}{\text{B. 9}}$, *Nepenthes* $\frac{\text{M. 7}}{\text{B. 1}}$,
Palmeæ $\frac{\text{M. 142}}{\text{B. 68}}$.

Orders with a great preponderance in Burma—

*Capparideæ*t $\frac{\text{M. 14}}{\text{B. 20}}$, *Balsamineæ* $\frac{\text{M. 7}}{\text{B. 40}}$, *Leguminosæ* $\frac{\text{M. 297}}{\text{B. 380}}$,
Rosaceæ $\frac{\text{M. 33}}{\text{B. 66}}$, *Compositæ* $\frac{\text{M. 27}}{\text{B. 160}}$, *Acanthaceæ* $\frac{\text{M. 34}}{\text{B. 226}}$,
Labiatæ $\frac{\text{M. 10}}{\text{B. 46}}$, *Cupuliferæ* $\frac{\text{M. 37}}{\text{B. 46}}$, *Bambuseæ* $\frac{\text{M. 8}}{\text{B. 15}}$.

This latter statement demonstrates the much stronger affinity of the Burmese Flora with that of the Deccan. The maximum difference between the two Provinces is shown by the genus *Impatiens*, the 7 Malay Peninsula species being altogether different from the 40 Burmese. One species is the most singular of all known Balsams (*I. mirabilis*), with a simple or branched trunk often four feet high and as thick as a man's leg. It is a native of the small island of Lankani off the coast of Kedah.

Of Conifers 5 species are recorded for the Peninsula belonging to the genera *Agathis*, *Dacrydium*, and *Podocarpus*; of *Cycadeæ*, only *Cycas Rumphii*. The small Order *Monimiaceæ*, of which two genera and as many species are natives of the Peninsula, is unknown in Burma (though inhabiting the Nicobars), but is represented by two species in Ceylon.

The islet of Penang, lying opposite the coast of Wellesley, distant 10 miles, demands a separate notice, if only for the fact of the astonishing number of species, and so many of them arboreous, that it contains. Though its area is only 106 square miles, and its greatest elevation 2,750 feet, yet, according to a catalogue of its flowering plants drawn up and printed (1894 ?) by Mr. C. Curtis, F.L.S., Assistant Superintendent of its Forests, it contains 1,813 species, together with 173 Ferns and their allies. With the exception of one, the 10th (*Apocyneæ* replacing *Scitamineæ*) the ten dominant Orders are the same as those I have given as the decad of the whole peninsula, but they do not follow the same sequence, *Rubiaceæ* ranking first, *Leguminosæ* fourth, and *Orchideæ* third; and the proportion of Monocotyledons to Dicotyledons is very different, 1 to 4·1. Other Orders largely represented are *Myrtaceæ* 35, *Acanthaceæ* 31, *Dipterocarpeae* 28, *Myristicaceæ* and *Guttiferæ* 25 each, *Cupuliferæ* 17 (of which 13 are Oaks), Palms 34. Of *Compositæ* there are only 23; of Bamboos one only, of *Nepenthes* 3, of Gymnosperms 8 (*Gnetum* 4, a *Dacrydium*, *Agathis*, and 2 *Podocarpi*).

The Cocos and Keeling islets, in the south Indian Ocean, 500 miles S.W. of Java, and still more distant from Singapore, are British possessions, which have in recent years been transferred from the Government of Ceylon to that of the Federated Malay States. Their scanty Flora is purely tropical Indian, and in great part littoral. Mr. H. B. Guppy spent ten weeks there, and made a very interesting collection of seeds and fruits cast up on the shores of Keeling's Island, of which a list has been published by Mr. W. B. Hemsley, F.R.S.—See *Nature*, xli., 491, 492; and *Science Progress*, i., 40.

APPENDICES.

APPENDIX A.

Flora of the Kuram Valley. (*See p.* 8.)

The Kuram is the only valley in the long range of mountains bordering British India on the west of the Indus of which the Flora has been described. It was exhaustively explored by Surgeon-Major J. E. T. Aitchison, F.R.S., in 1879–80, who collected in it about 900 species of Flowering plants, and 26 Ferns and their allies[*]. The valley is nearly 100 miles long, and the elevations at which the collections were made varied from 2,000 feet above the sea at the mouth of the valley to 15,000 feet on its flanks; that is from the tropical Flora of the Indus Plain to the alpine of the Himālaya. Of the 93 Orders to which the Flowering plants belong, the following 10 are the dominant. The added numbers in brackets indicate the positions of the same in the Western Himālayan Province:—

1. *Compositæ* (2).
2. *Gramineæ* (1).
3. *Leguminosæ* (3).
4. *Labiatæ* (5).
5. *Rosaceæ* (9).
6. *Cruciferæ* (8).
7. *Umbelliferæ*.
8. *Ranunculaceæ* (6).
9. *Boragineæ*.
10. *Cyperaceæ* (4).

The low position of *Cyperaeæ*, and the subjection of *Gramineæ* to *Compositæ*, may be attributed to the dryness of the climate, as also may the prevalence of *Boragineæ*. The genera and most of the species are Himālayan, the chief exceptions being such plants as *Herniaria* and *Peganum* which are typical of the Indus Plain. The nine *Coniferæ*, which include the Deodar, are all Himālayan. The only Palm is *Nannorhops Ritchieana*, which extends from the Salt Range to Sind and Balūchistān. The distinctively Oriental genera, such as *Pistacia* and *Eremurus*, are few. Of *Bambuseæ* there are none. On the whole, the Flora may be regarded as a dying-out Himālayan, and not as typically Oriental. It differs considerably from that of British Balūchistān.

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[*] *Journal of the Linnean Society of London*, Bot. vols. xviii. and xix.

APPENDIX B.

Flora of British Balūchistān. (*See p.* 8.)

The small tract of country (about 180 miles long) bearing the above name is enclosed between Afghānistān and independent Balūchistān. It is mountainous, 5,000 to 8,000 feet elevation above the sea, with peaks rising above 10,000 feet, and its climate is one of great extremes of cold and heat. Not having been made over to the Government of India until the early volumes of the *Flora of British India* were considerably advanced, its plants were not taken up in that work.

Only three botanists have collected in it. Griffith[*] in the spring of 1839 passed through it when accompanying the army of the Indus from Shikarpur to Kandahar, Dr. Stocks[†] visited it in the spring of 1850, and Mr. J. H. Lace, F.L.S. (of the Indian Forest Department) resided in it from 1885 to 1888. Some of the plants collected by the first two travellers are included in Boissier's *Flora Orientalis*, and excellent observations on the vegetation of the country are published in the works cited below. Mr. Lace alone was enabled to make a detailed botanical exploration of the district. He collected upwards of 700 species, which, aided by Mr. Hemsley, he has published[‡], prefacing his account with an exhaustive description of the botanical features of the country. These materials prove the Flora to be Oriental, with an admixture of Himālayan and Indian plants; it is Afghan in short, and very different from that of the Indus Plain, and of Balūchistān in its lower levels, which is more Arabic-Persian. It may be gathered from the observations of these three botanists that the vegetation is, though poor, very varied and presents many local assemblages of species, dependent upon climate, soil (including saline), humidity and elevation within a very limited area. The 10 dominant Orders of the 82 in Mr. Lace's collections are the following, with, in brackets, their relative positions in the Kuram Valley Flora:—

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[*] "Posthumous Papers," vol. i., p. 336.

[†] Hooker's *Journal of Botany*, vol. ii. (1850), p. 303, vol. iv. (1852) pp. 142, 172.

[‡] "Sketch of the Vegetation of British Baluchistan, with Descriptions of New Species," *Journal, Linnean Society*, Bot. vol. xxviii. (1891) p. 288.

1. *Compositæ* (1).
2. *Gramineæ* (2).
3. *Leguminosæ* (3).
4. *Cruciferæ* (6).
5. *Labiatæ* (4).
6. *Chenopodiaceæ*.
7. *Boragineæ* (9).
8. *Liliaceæ*.
9. *Caryophylleæ*.
10. *Rosaceæ* (5).

Of the 82 Orders, no fewer than 20 are monotypic, including *Acanthaceæ* which is well represented in every other botanical Province of India. The forest trees are *Juniperus macropoda* (the only Conifer), which is found at 7,000 to 10,000 feet elevation; *Populus euphratica* and species of *Pistacia*, *Dalbergia*, *Celtis*, *Acacia*, *Prosopis*, *Salix*, *Fraxinus*, *Ulmus*, *Cratægus*, and *Tamarix*. The Pomegranate and Fig are indigenous. *Nannorhops* is the only Palm. There are no *Bambuseæ* in the collections, and only six Ferns.

Before concluding, it must be recorded that the very considerable European and Oriental Order of *Cistineæ* has its extreme eastern limit in Independent Balūchistān. Stocks collected *Helianthemum Lippii*, a widely distributed species extending from the Levant to Persia, near Gundava, 60 miles south of the British frontier. Should it be found within the latter it would add a Natural Order of plants to British India.

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[*] The Oriental Plane (*Platanaceæ*) included in Mr. Lace's list I assume to have been introduced.